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DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with each copy of this week's issue.

The Storstrøm Bridge

ALTHOUGH there is no intrinsic merit in the length of a bridge, there is some satisfaction in the thought that most of the very long bridges in the world have been British built. The Storstrøm bridge, 10,535 ft. or just over 2 miles long, which was opened by the King of Denmark on Sunday, is the longest bridge in Europe, beating the Tay bridge by a matter of about 8 ft., but whereas the latter, in common with most of the other very long bridges, is of British design, the Storstrøm bridge is the result of the fertile brain of Herr Anker Engelund, Bridge Engineer of the Danish State Railways and Professor of Structural Engineering at Copenhagen, and a remarkable design it is. The principle of alternating cantilever and suspended spans of great plate girders has resulted in an economical and graceful design, the practical application of which in Chromodor high-tensile steel by the British firm of Dorman, Long & Co. Ltd., has been carried out well within the contract time and without a hitch. Acting as sub-contractors to Dorman, Long, Christiani & Nielsen displayed much ingenuity in the construction of the 49 piers supporting the bridge. Some details of the whole work have already been given in our issues of April 28, 1933, and March 20, 1936. The opening ceremony last Sunday was attended by Dr. Leslie Burgin, the British Minister of Transport, and Mr. Oliver Stanley, President of the Board of Trade, as well as by a distinguished gathering of railway and other eminent personages from Denmark and the neighbouring countries. By eliminating a train and car ferry on the main route between Copenhagen and Berlin the new bridge, together with the smaller neighbouring bridge over the Masnedsund, has enabled a reduction in the journey time of trains by some 50 min. to come into force with the Continental winter timetables dating from September 27. A corresponding saving in transit time for road vehicles is also effected, for the bridge carries not only the railway but an 18-ft. road and a pathway for cyclists and pedestrians.

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The Week's Traffics

Another good batch of traffics is shown by the four group railways for the past week, with a combined increase of £125,000, as compared with an increase of £105,000 for the previous week. As before, the principal advances were in coal and merchandise. To date the total earnings of the four companies amount to £120,338,000, an increase of £4,991,000 or 4·33 per cent. The passenger train receipts of £55,067,000 show an advance of £2,241,000 or 4·24 per cent. In merchandise the gain is £1,231,000 net or 3·09 per cent. with earnings of £41,080,500, and in the coal class the traffic of £24,190,500 shows a net advance of £1,519,000 or 6·70 per cent.

	38th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 5,000	+ 19,000	+ 32,000	+ 56,000	+1,845,000	+ 3·96
L.N.E.R. ..	+ 3,000	+ 13,000	+ 17,000	+ 33,000	+1,613,000	+ 4·78
G.W.R. ..	+ 5,000	+ 6,000	+ 11,000	+ 22,000	+ 981,000	+ 5·07
S.R. ..	+ 15,000	− 2,000	+ 1,000	+ 14,000	+ 552,000	+ 3·51

Mersey railway traffics for the week show an increase of £61 making the gain to date £5,080. On the Great Northern Railway (Ireland) the past week's improvement of £50 reduces the decrease to date to £2,800. The Great Southern is £17,925 behind in receipts for the current year so far.

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Twenty-four Weeks' Freight Traffics

The Ministry of Transport Statistics for the month of May, 1937, include a freight traffic analysis for all British standard-gauge railways during the 24 weeks ended June 12, 1937. This shows on the whole a rise of 5·62 per cent. in tonnage and of 4·46 per cent. in receipts compared with the corresponding period of 1936. Higher class merchandise tons were 23,832,426, an increase of 1,566,876 tons or 7·04 per cent., with receipts of £19,541,428, which were higher by £798,217 or 4·26 per cent. Of minerals and merchandise (Classes 1-6) 26,199,579 tons were conveyed, an advance of 1,044,165 tons or 4·15 per cent., although the receipts of £6,697,605 showed an increase of only £63,482 or 0·96 per cent. Coal class tonnage was 87,618,526, a gain of 4,788,150 tons or 5·78 per cent., and in the receipts of £16,526,982 the improvement was £1,011,147 or 6·52 per cent. Livestock receipts, at £575,551, were down £21,017 or 3·52 per cent. During the twelve weeks ended June 12, 1937, the higher class merchandise tonnage of 12,042,217 showed an increase of 948,405 tons or 8·55 per cent., and the receipts of £9,837,326 therefrom were higher by £411,102 or 4·36 per cent. Tonnage in Classes 1-6 was 13,617,874, an increase of 658,729 tons or 5·08 per cent., but in the receipts of £3,457,495 the improvement was only £11,588. Coal class tons were 42,428,883, being higher by 4,305,344 tons or 11·29 per cent., and the improvement in the receipts of £7,857,504 was £938,468 or 13·56 per cent. Livestock receipts amounted to £308,485, a decrease of £17,301 or 5·31 per cent.

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British Visit to the Reichsautobahnen

The whole of this week is being devoted by an important British party to an inspection of the *Reichsautobahnen*, or German State motor roads. The visitors, numbering some 225, include 60 Members of Parliament; they left London last Friday and were entertained during the week-end by their host, Dr. Todt, the Inspector-General of the new roadway system, and by Dr. Julius Lippert, the Lord Mayor of Berlin. On Monday began the serious programme of inspection, which was carefully designed to give the visitors ample opportunity of examining the various types of road and junction, ranging from comparatively level sections in plainland to the German Alpine road to Berchtesgaden. We imagine that many members of the party will have been considerably surprised by the extent of road development in Germany; by the careful layout for high speed with safety; and by the excellence of the workmanship. Today (Friday) the party is to witness the opening ceremony by Dr. Todt of the new Karlsruhe—Bruchsal road, before returning to England via the Rhineland.

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Developments at Sheepbridge

Interesting statements regarding the present position and future possibilities of that prosperous undertaking, the Sheepbridge Coal & Iron Co. Ltd., were made by Mr. W. H. McConnel (the Chairman) at the general meeting of the company on September 27. Sheepbridge produces approximately 1¼ million tons of coal per annum at its own collieries and is directly interested in the production of about 4¾ million tons per annum at the Newstead and Yorkshire Amalgamated Collieries in the management of which Sheepbridge has a share. For the past year the net profit secured by the company was £226,895, an increase of £52,040, and the dividend for the year is 10 per cent. on all shares, free of tax. On the subject of "oil from coal," the chairman referred to the progress of a small company formed to develop the conversion of gas into oil, in which company Sheepbridge has a few shares. A small commercial plant is being put down at a colliery in Scotland, and it is hoped that the plant will be in operation early next year. Another interesting reference by the chairman was to a development in America leading to the production by synthesis from natural petroleum of a special type of motor fuel known as iso-octane. His company's product, the raw material being coal, was more suitable for iso-octane development than natural oil.

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Efficiently Handling a Heavy Wheat Crop

The railways played an important part in the peak movement of one of the heaviest winter wheat crops on record in the United States. The transportation of grain during the harvest weeks is now one of the biggest problems which railways in that country have to tackle. Before the combines proved so popular, the movement of the winter wheat crop was more gradual. Loading of grain was spread over the months of July and August and on into the Autumn as threshing machines moved from farm to farm. The problem this year was exceptionally difficult, as owing to the depression there had been a reduction in the number of vans available for grain loading. Also weather conditions were such that the whole of the winter wheat area from Texas, through Oklahoma, into Kansas came into harvest at the same time. The successful handling of this huge crop was the result of co-operation on the part of the railways, grain elevators, and flour and feed mills, and several months of careful planning by the Car Service Division of the Association of American Railroads and the Southwest and Trans-Missouri-Kansas Shippers' Advisory Boards. On July 10, Kansas City received 1,956 vans containing more than 3,000,000 bushels of wheat, a record for one day. The former record of 1,487 vans was set up on July 11, 1931.

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Automatic Crossing Gates

Installed by the Louisville & Nashville Railroad at Anchorage, Kentucky, near Louisville, the automatic level-crossing gates illustrated on page 562 provide a solid protective fence when let down. The 36 ft. arms, when in the open or upright position, are not very much different in appearance from those of the conventional American crossing gate. As they are lowered, however, a folding fence comes into operation letting down a pair of auxiliary arms which rest about a foot from the ground parallel with the upper arms. This type of double gate is specially effective at crossings near schools where large numbers of children have to cross. The gates are operated by electric-hydraulic apparatus and automatically begin to lower about 15 sec. before the passage of the train, during which time a loud gong sounds a warning. At night, the gong is supplemented by flashing red lights at intervals of 10 ft. along the arms. The arms when upright stand at an angle of about 70 deg. to the horizontal, and these red flashlights thus form an illuminated flashing arch which can be seen a good distance from the crossing. A vehicle caught on the track can escape, as a slight contact causes the gates to pivot outward away from the track to permit egress without damage, but the gates cannot be pushed inward. They rise automatically 5 sec. after the passage of the train, and there is no excessive delay during shunting operations, as the gates automatically rise whenever the shunting engine is at a standstill, if it is clear of the crossing.

* * * *

Excessive Speed

A summary of Col. A. C. Trench's report on the derailment at Sleaford, L.N.E.R., on February 15, 1937, appears on page 567. He concludes that there was nothing wrong with or on the track. One condition afterwards found in the locomotive—unequal wheel weights—may have had some slight bearing on the occurrence, but its fundamental and very serious cause was the excessive speed—40 m.p.h. or over—with which the driver undoubtedly took the curve of the junction towards Sleaford station, the speed limit being 20 m.p.h. It is disquieting to read that, after the publicity accompanying the case, trains have been timed through the spot at 40, and even 47 m.p.h., a disregard for important instructions fraught with the gravest possibilities. Col. Trench draws attention to the benefit to be had from speed indicators and recorders on locomotives, endorsing what Col. Mount said on the subject after the derailment of a Waverley—St. Pancras express at Carlisle on January 3, 1931. If high speed is to be combined with safety it is essential that speed restrictions be respected. The first step to ensure this is to give the driver an indication of his speed.

* * * *

Locomotive Speed Indicators

Insistence is usually laid mainly on the safety value of the locomotive speed indicator, as giving to a driver a clear indication when he has reached the maximum speed permissible over any stretch of line, or has correctly reduced to the limit of speed specified over a curve or elsewhere. But the speed indicator should also be used to prevent reductions of speed considerably more severe than those called for. It is not necessarily a mark of good driving when a driver takes his train with excessive

caution round a curve; on the other hand, valuable energy is being destroyed, and to recover the time thus thrown away, the engine will have to be driven harder and coal consumption and wear-and-tear over other parts of the journey will be increased if time is to be kept. On the streamlined express services in this country, where the engines are provided with self-recording speed indicators, drivers, with the exact evidence of the speed indicator before them, might just as well be dealt with for over-emphasis on speed restrictions as for under-emphasis, for some of the point-to-point times of these trains are so tight that any avoidable loss of time in this way may be recouped by excessive speed elsewhere. Further, this undue caution is so unnecessary, seeing that in Great Britain, in view of the general absence of speed indicators, speed restrictions are invariably framed on the severe side, to allow for a driver's possible under-estimate of the rate at which he is travelling.

* * * *

Side Thrusts at Speed

Important data as to the magnitude of the lateral thrusts exerted at high speed by modern express locomotives have been obtained from tests conducted by the P.L.M. Railway as a preliminary to the introduction of the high-speed steam service from Paris to Lyons, and its successor the 60-m.p.h. schedule from Paris to Marseilles, brought into operation this summer. These investigations, described in a recent issue of the *Revue Générale des Chemins de Fer*, were conducted with one of the streamlined Atlantics and a standard Pacific, and it was shown that on a good piece of straight track the leading coupled axle could produce maximum momentary thrusts of 4·7 *tonnes* and 6·4 *tonnes* respectively at 81 m.p.h. At 87 m.p.h. the Atlantic did not show a higher thrust, but the Pacific registered 7·8 *tonnes*. On curves of 5,000-ft. radius the leading coupled axle of the Atlantic gave a momentary thrust of 5·1 *tonnes* at 87 m.p.h., and on a 4,000-ft. curve of 9·8 *tonnes* at 81 m.p.h.; whereas the Pacific gave only 7 *tonnes* on the 4,000-ft. curve at 81 m.p.h., but registered almost as much, 6·6 *tonnes*, at the same speed on a 7,500-ft. curve. The maximum thrust recorded by the Mauzin quartzite apparatus was 13·7 *tonnes* from the leading axle of the Pacific when rounding a 2,300-ft. curve at 65 m.p.h.; but before the leading bogie of the Atlantic was modified to give greater guiding action, thrusts up to 10 *tonnes* were produced on the straight at 87 m.p.h. by the leading coupled axle of that machine. Increasing the guiding effect of the bogie and thinning the tyres of the leading coupled wheels were found to be the best methods of reducing the maximum thrusts.

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Locomotive Inspection in America

Mr. John M. Hall, chief officer of the American Bureau of Locomotive Inspection, recently produced a striking analysis of the results of 25 years of federal locomotive inspection. He remarked that the results of the Act under which these investigations are made, as amended and enforced in the intervening years since its first passage in 1911, had been of a striking order. He credited the Act with preventing 1,622 deaths and 14,695 injuries, or a reduction of 64·7 per cent. in the number of deaths and 48·9 per cent. in the number of injuries that would have occurred if casualties had continued at the same rate as in the first year the Act and its amendments became effective. He states that these estimates, moreover, do not take into consideration the large but indeterminate reduction of killed and injured, caused by the practical elimination of steam leaks which obscure the view of enginemen. At the time when the Act was inaugurated, considerable antagonism and lack of co-operation were shown, but this has largely disappeared and the sincere co-operation of the railways with the bureau has been responsible in considerable measure for the results achieved. The railways, Mr. Hall went on to say, had come to realise that instead of the bureau being a hindrance, inspection by the Federal Government is helping them not only to operate with greater safety, but to keep locomotives in better condition, which means economy in operation, fewer failures, and fewer accidents.

* * * *

The Taper Boiler Again

There would still appear to be a fairly wide diversity of opinion among locomotive engineers as to the relative advantages of parallel and taper boiler barrels, and if the matter be regarded from the point of view of current practice on British railways, the majority verdict certainly favours the first of these types. Much has been made of the alleged difficulties of manufacturing taper, or as they are often called coned, locomotive boiler barrels, but with modern appliances and better understanding of the principle involved, no difficulty on this score need be feared at any works where locomotive boilers can be made at all. An engineer whose experience entitles his opinions to be regarded as trustworthy and as compelling respect, has stated that by tapering the larger section of the boiler, additional steam space is procured, whilst there is also obtained an increased water line for the steam to come off. Other advantages of the tapered boiler are that at the front end, where excessive weight often raises a difficulty, the load can be kept down to within reasonable limits; also, when the engine is running downhill, the water is kept on the crown plate of the firebox. These considerations were put forward as some of the points in favour of the tapered boiler. It is one of those matters providing material for discussion, without which much of the interest in the locomotive subject must tend to evaporate.

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The Art and Craft of Illuminated Advertising

A writer to a London daily has recently been bemoaning the murky and featureless appearance which railway station exteriors present at night. "Why not," he asks, "make them bright and attractive with illuminated advertisements?" Knowing the passion of railway officials of a bygone day for covering stations with a crust of enamelled iron signs of a declamatory nature, we can only pray for interference from Above should the present generation seek to commemorate itself by bedecking these venerable premises with yards of neon nightmares. Consider the nocturnal appearance of scores of buildings in the West End of London seemingly writhing in kaleidoscopic convulsions as they strive to register in the minds of the passer-by the catchpenny names of a thousand different objects. Ruby coruscations pertly enquire if our feet ache, a leering purple snake demands that we put our liver in order by swallowing somebody's coloured *aqua vitae*. High above our heads a footling bottle alternately pours twinkling cascades of sham port and sherry into an ever gaping glass, while volcanic eruptions of green and scarlet do dual service by first proclaiming a whisky and then a family motorcar. A brilliant white and foaming light in the sky does not herald the coming of angels but merely lures one on to sample the untried joys of a milk bar. Think too of the magic strips of lighting whereby a building of mournful and faded appearance by day acquires at night astonishing architectural features with which its builder neglected to endow it.

Increased Railway Charges

THE commercial staffs of the four main-line railway companies and the Railway Clearing House have experienced a particularly arduous time during the last two months in compiling and issuing the comprehensive and detailed instructions which have been necessitated by the decision of the Rates Tribunal that as from October 1 an increase of 5 per cent. should be applied as far as practicable, subject to certain reservations, to the standard and exceptional charges of each company. Apart from purely railway charges, the passenger departments, for instance, have had to negotiate the future level of through fares with a large number of road, river and steamboat companies in conjunction with whom such facilities have been so extensively introduced in recent years. The position in connection with through rates and fares to Ireland has also occasioned some difficulty as the Great Southern Railways of Ireland have already lodged an application with the Irish Rates Tribunal for authority to increase their charges between interior stations in Ireland and, pending the decision, were unable to associate themselves with the application of a 5 per cent. increase to the throughout fares. No change is being made in the rates and charges in Northern Ireland until the decision in regard to the Great Southern Railways application is published and arrangements have therefore been made to calculate the increase on all such through rates and fares as between the stations in Great Britain and the Irish ports, leaving any increase in respect of the distance from the port to interior Irish stations to be determined later.

Apart from the standard and exceptional charges of the main-line companies, there is, of course, a very wide range of charges for miscellaneous or extraneous services which are not subject to the jurisdiction of the tribunal. These have each been carefully considered and, while the majority are being increased by the appropriate figure, the companies have decided not to increase the charges for such facilities as cloakrooms, platform tickets, reservation of seats, passengers' luggage in advance, parking of cars, and registered transits by passenger or merchandise trains. The decision not to increase the charges for certain of these minor services and the decision of the tribunal that certain very low charges should be exempted from any increase will not, it is considered, entail any substantial modification in the sum which it was originally estimated would be obtained from the increase. The companies indicated to the tribunal that probably an additional annual net revenue of £5,600,000 would be secured, but owing to the many and varied considerations involved, this figure must obviously be subject to wide variation.

It will be observed that, as the tribunal was reviewing only the financial results of the four main-line companies, its decision that the charges should be increased covered only those undertakings. Applications were therefore lodged last month with the tribunal in respect of all the railway undertakings in Great Britain which are jointly owned, and also by the various non-amalgamated railway companies, for a similar increase to be authorised in respect of their rates and charges. These applications cannot possibly be determined by the Rates Tribunal until after the higher charges have been introduced by the main-line companies, and permission is therefore being sought for the increases to be applied retrospectively to October 1 to avoid the difficulties which would otherwise be experienced in connection with the charging of through rates and fares as from that date. As previously mentioned in these columns, the increase does not apply to the London suburban passenger fares of the four main-line companies, because Section 33 of the London Passenger Transport Act, 1933, provides that Part III of the Railways Act, 1921—under which the annual review of charges, *inter alia*, is conducted—shall cease to apply to such fares. Any application to increase them must therefore be made separately to the Rates Tribunal under Section 34 of the 1933 Act. Having regard, however, to the pooling arrangements which now exist with the London Passenger Transport Board, the main-line companies are giving close consideration to the matter with the board, but we understand that no decision has yet been reached. Should it be decided to apply for authority to increase any of the fares, however, it seems improbable that the necessary application can be lodged and heard by the tribunal in sufficient time for any increase to operate before January 1, 1938.

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Dr. Samuel Smiles

STEPS are being taken to establish a Memorial to Dr. Samuel Smiles at Zion School, Leeds, and we are indebted to Mr. E. Kilburn Scott, the organiser, for sending us particulars of the contemplated arrangements. Briefly, these include the erection of a tablet on the original building of Zion School, giving particulars of Dr. Smiles's career and connection with it; the donation of a set of books with a bookcase to a Municipal branch library which occupies part of the building; and the presentation of a framed portrait of Dr. Smiles, suitably inscribed, for the main hall of the school. A souvenir programme with biographical notes is being prepared, and, if sufficient funds are secured, it is proposed that copies of Dr. Smiles's books be given as prizes to scholars of the Sunday School. Although it will be seen that the proposed memorial is concerned with the educational work of Dr. Smiles, doubtless the scheme will appeal to a far wider circle in view of his outstanding work as a railwayman, and a writer.

Dr. Smiles was born at Haddington in Scotland on December 23, 1812, and as he was the eldest of eleven children left, on their father's death, to be supported by their mother, he received an early insight into the quality of self-reliance which is so noticeable a feature of his later career and writings, and is exemplified by his famous volume entitled "Self Help" which originated from notes of the lectures he gave at Zion School, Leeds; this volume has since been translated into 22 languages. He was educated at Haddington Grammar School and Edinburgh University, and after graduating in 1832 tried unsuccessfully to practise medicine in his native village. He then transferred his interests to journalism, and from 1838 to 1844 edited the weekly *Leeds Times*, and though he gave up regular journalism in the latter year he continued to be a frequent contributor to periodicals and was, in fact, an extraordinarily prolific writer. His railway career began at the end of 1845 when he joined the staff of the Leeds & Thirsk Railway as Assistant Secretary, and shortly afterwards became Secretary, a post which he continued to hold until 1854 when that railway became merged in the North Eastern Railway.

His residence in Leeds gave him opportunities for studying some of the remarkable men connected with early days of railways, and, when he went to Newcastle in connection with the taking over of this railway, he was able to gratify a long-standing desire to move among contemporaries of George Stephenson. The material thus collected resulted in the appearance of his famous "Life of George Stephenson," the success of which encouraged him to write biographical volumes about many of the early engineers such as James Brindley, Thomas Telford, Matthew Boulton, and James Watt. Dr. Smiles entered the most notable era of his railway career in 1854 when he was appointed Secretary of the South Eastern Rail-

way, and although he retired finally from the railway world in 1866, the intervening 12 years had seen him take a prominent part in some noteworthy railway developments in the South of England, culminating in the establishment of the Charing Cross Railway. While he was still Secretary of the South Eastern Railway he joined with the late Edward McDermott in establishing *The Railway News*, one of our constituent papers, the first issue of which appeared on January 2, 1864. His direct association with the paper was not of long standing, and *The Railway News* continued under the direction of Edward McDermott, and subsequently his two sons until its amalgamation into THE RAILWAY GAZETTE, but Dr. Smiles continued to take an active interest in its well-being and often contributed to its columns. His literary interests continued to his death, which took place at Kensington on April 16, 1904, when he had reached the advanced age of 91.

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Streamline Service

WITH the inauguration of the West Riding Limited on Monday last, the London and North Eastern Railway completes its trio of streamlined trains, which have established new standards of speed in this country. It is not without interest that three days later the Silver Jubilee—first of the three to take the road, on September 30, 1935—celebrated its second birthday. During that period, in the course of 988 journeys, the train has covered 265,080 miles and carried 135,320 passengers; all but 230,000 miles of the distance have been run at a booked average of 70·4 m.p.h., and probably at least 100,000 miles have been covered at 80 m.p.h. and over. In the course of ordinary running maximum speeds of 100 m.p.h. have been reached on several occasions, the highest figure being 113 m.p.h. Out of the four engines specially allocated to the Silver Jubilee service, three have borne the brunt of the work, the fourth being kept at Gateshead as a stand-by, and used on other trains when not needed on the Silver Jubilee; still more remarkable, very nearly the entire mileage to date has been achieved by the one set of coaches originally built, the only opportunities for overhaul being Saturdays and Sundays, and the short periods round the public holidays when the train has not been run. But it has not been merely speed, internal equipment, or appearance that have commended themselves to the travelling public; it has been the reliability of the Silver Jubilee's timekeeping that has probably proved even more attractive, for the number of late arrivals due to fog, breakdowns of other services causing delay, or similar extraneous reasons, has been very small, while breakdowns of the engine or coaches themselves have been rare indeed. More than half the arrivals have been from one to five minutes early. With such combined attractions as speed, comfort and exceptional punctuality, it is not surprising that the Silver Jubilee continues to book to capacity day after day, and that it has proved the most profitable of all L.N.E.R. train service experiments.

It was stated by the London & North Eastern Railway management, when the Silver Jubilee began to run, that this train was intended to test the reactions of the British public towards high speed travel, and whether small supplementary charges in exchange for the extra facilities afforded would find favour or not. The answer could hardly have been more emphatic than it has been; and the L.N.E.R., on its part, has accepted this popular verdict by putting into service this year the Coronation express and the West Riding Limited. These three remarkable trains between them are now responsible for covering all but 1,700 miles daily at start-to-stop speeds ranging up to a maximum of 71·9 m.p.h., which is the booking of the down Coronation from King's Cross to York, and the fastest scheduled run in the Empire. Over the Southern Area of the L.N.E.R., where the timetable calls for the hardest running, the combined average of all six runs between Hatfield and Doncaster, three in each direction, is but a fraction under 75 m.p.h. for a total of 830 miles daily. This is the scheduled figure, and includes the severe service slack through Peterborough, as well as out-of-course slowings for relaying or other similar reasons. That consistent punctuality at such speeds has been possible with the Silver Jubilee has been due largely to the rigid limitation of tare load to 220 tons; how the 278-ton West Riding Limited and the 312-ton Coronation will fare during the winter, when renewal work on the track recommences and the weather deteriorates, remains to be seen. Already it is clear that the Coronation's load imposes a much harder task on the locomotives south of York than the Silver Jubilee, and that necessarily lower uphill speeds are having to be balanced by still higher downhill speeds if time is to be kept. Such spacious luxury as that of the two trains introduced this year can be provided at the same speeds as those of the first streamliner only if the price be paid of additional power output; and for strict timekeeping—a *sine qua non* when supplementary fares are charged for high speed—it is essential that the power unit shall have some reserve with which to meet abnormal demands.

Another feature of the L.N.E.R. streamline services is the new fashion that they are setting in late evening departures for long-distance journeys. Public feeling has already been tested in the case of Leeds by the 7.15 p.m. from King's Cross, roughly 1½ hr. later than the latest possible departure from King's Cross to the West Riding up to the end of 1935, and this has proved so popular that 7.10 p.m. has been selected as the starting-time from London of the West Riding Limited. Yet the passenger is brought into Leeds only 10 min. behind the 5.50 p.m. train from King's Cross. Similarly the up Coronation permits a start from Newcastle at 6.33 p.m., 2 hr. later than previously, but London is reached 15 min. earlier than it was by the 5.4 p.m. express—the last train of the day—of the pre-war era. Again, the East Anglian, serving Ipswich and Norwich, which also began to run on Monday last, leaves Liverpool Street at 6.40 p.m., and, apart from streamline services, the same tendency is seen in the new 8 p.m. L.M.S. dining car express from St. Pancras to Sheffield—1¾ hr. after the latest post-war evening departure for Sheffield—the 6.20 p.m. from Manchester to St. Pancras, and the 6.55 p.m. Great Western dining car express, put on in July last, from Paddington to Newport and Cardiff. For years past, of course, such Continental capitals as Paris and Berlin have enjoyed far later departures to their provincial cities than London; and the practice, which attracts in particular the business man by extending the length of his business day without keeping him away from home overnight, is thus spreading with advantage to Great Britain.

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The Optimum Superheat Temperature

ONCE again the vexed question of the optimum superheat temperature has been raised, this time by Mr. H. B. Oatley, Vice-President of the Superheater Company of the U.S.A., in a *Railway Age* article entitled "What Limit to Superheat for Steam Locomotives?" In seeking the answer to his own question the author evaluates the

adiabatic heat drop for steam with different initial superheats and pressures, but the same terminal or release pressure, and, as was to be expected, he found that this heat drop (which is a measure of the work obtainable from the engine per pound of steam used) increased with every increase in the initial temperature and pressure. Every student of thermodynamics knows about this small gain that theory shows to be obtainable from superheating, and in *The Railway Engineer*, shortly before its incorporation with this journal, there appeared articles in which the gain was tabulated and graphed for a wide range of working pressures and temperatures. A gain not mentioned by Mr. Oatley, but recorded by Professor G. V. Lomonossoff and C. A. J. Elphinston in THE RAILWAY GAZETTE of April 19, 1935, is that due to the increasing fluidity of steam with increasing temperature. Increased fluidity minimises leakage at the same time, and the authorities mentioned gave it as their opinion that the limit of superheating was set by leakage. Mr. Oatley again drags the old red herring of superheated exhaust steam across the prospect, but he deals with it in the correct way by showing that although there is an increase in the heat content of each pound of exhaust steam when the superheat temperature is raised, fewer pounds of steam are used per i.h.p. hr., so that, on the whole, the wasted heat per i.h.p. developed is less rather than more. It is to be hoped that this particular red herring may now be permitted to pass on to its eternal rest.

LETTERS TO THE EDITOR

(*The Editor is not responsible for the opinions of correspondents*)

London-Cambridge Train Services

56, St. Mary's Mansions, Paddington, W.2
September 25

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—The revival of the St. Pancras-Cambridge service, suggested in your issue of September 24, should be quite practicable with the co-operation that now exists between the L.M.S.R. and L.N.E.R., and would overcome the difficulty of working non-stop trains to Cambridge from King's Cross. But a stop at Kentish Town (to facilitate access to and from the Hampstead and Charing Cross tube trains) would be desirable, and as 15 min. would then be necessary for the St. Pancras-Tottenham (Hale) length, 65 min. would, I think, be the best practicable booking to Cambridge. On the pre-war 12.20 from St. Pancras—the 71 min. train alluded to by Mr. Fellows—I have, however, records of times of 47½ and 48 min. over the 49·7 miles from Tottenham to Cambridge (after delays on the Tottenham and Hampstead line), and on one memorable occasion the 10.30 from St. Pancras (a 76 min. train to Cambridge, with a stop at Bishop's Stortford, which figured in the October, 1914, timetable) left at 10.47, stopped at Bishop's Stortford from 11.23½ to 11.24, and arrived at Cambridge at 11.50—equivalent to a 60 min. non-stop booking.

Yours, &c.,

R. E. CHARLEWOOD

Timetable Reorganisation

London, W.6, September 27

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—I agree with the editorial comment in your last issue that the reorganisation of the Midland timetable "is one of the most complete of any in British railway history." It is also one which I hope will by its success in operation help to rescue other sectional timetables on both the L.M.S.R. and the L.N.E.R. from the moribund state in which they have remained for so many years. It is surprising to note that the L.N.E.R. has made practically no attempt to counteract the effect which the Midland reorganisation is bound to have on two of its principal services—between King's Cross and Leeds, and Marylebone and the Midlands.

A fact that has escaped general attention is that there is not now a wide discrepancy in the qualities of the services offered by the two companies between London and Leeds. Several of the principal L.N.E.R. expresses have their journey times equalled and in some cases even slightly bettered by those of Midland trains having approximately the same departure times, as a glance at the summary tables in the public timebooks of these two railways will show.

Standardised departure times might have their first trial on a trunk route of the L.N.E.R. by application to the King's Cross-Leeds service. At present the principal departures from King's Cross are at 7.25 a.m., 10.10 a.m., 11.20 a.m., 1.30 p.m., 1.40 p.m. (connection), 4 p.m., 4.45 p.m., 5.50 p.m., 7.10 p.m., and from Leeds at 7.50 a.m., 9.0 a.m., 10.10 a.m., 11.31 a.m., 1.10 p.m., 3.10 p.m., 3.55 p.m., 5.30 p.m. It would need nothing like so radical a reorganisation as that brought into force on the Midland section to recast this timetable into one giving departures at 8.10 a.m. (giving an early morning service at a convenient hour), 10.10 a.m., 11.10 a.m., 1.10 p.m., 2.10 p.m., 4.10 p.m., 5.10 p.m., 6.10 p.m., and 7.10 p.m. in the down direction, and 8.10 a.m., 9.10 a.m., 10.10 a.m., 11.10 a.m., 1.10 p.m., 3.10 p.m., 4.10 p.m., and 6.10 p.m. in the up direction.

Turning to the service between Marylebone and the Midlands, it is evident that this route, which has never enjoyed extensive patronage, has now been robbed (apart from terminal convenience to the individual) of almost every advantage it possessed. Radical reorganisation will surely be necessary here if the service is to survive. From Sheffield, Nottingham, and Leicester the present timetable is easily adaptable into one giving a fixed interval service from all of these towns to Marylebone. Between the three northern towns there is already in operation a system of standard inter-city timings, and this practice should be extended south of Leicester.

As a "sample schedule" the present 7.30 a.m. from Sheffield might leave Nottingham at 8.20 a.m., Leicester at 8.50 a.m. and arrive at Marylebone at 10.35 a.m. A total timing of 3 hr. 5 min., allowing 50 min. (including stop) between Sheffield and Nottingham, 30 min. (including stop) between Nottingham and Leicester, and 105 min. from Leicester to London. This might be repeated throughout the day by expresses leaving Sheffield at 9.30 a.m., 11.30 a.m., 1.30 p.m., 3.30 p.m., 5.30 p.m., and 7.30 p.m. (The present departures are at 9.35 a.m., 11.20 a.m., 3.30 p.m., 5.02 p.m. and 6.21 p.m.). The proposed 1.30 p.m. is a much needed new train, and the 7.30 p.m. would balance the Midland 8 p.m. up train. A similar arrangement of trains should come into operation from London with trains at 8.15 a.m. (providing the long-desired early morning service), 10.15 a.m., 12.15 p.m., 2.15 p.m., 4.15 p.m., 5.15 p.m., and 6.15 p.m. reaching Leicester in 104 min., Nottingham in 130 min. and Sheffield in 178 min. in each case. With the locomotive power even now available (disregarding the future appearance of Pacifics) and existing loads, these schedules would present not the slightest difficulty in operation. (Present departures from Marylebone are at 8.45 a.m., 10.0 a.m., 12.15 p.m., 3.20 p.m., 4.55 p.m. and 6.20 p.m.). Perhaps the best advertisement for speed on the Great Central line is provided by the comparative popularity of the 3.20 p.m. and 6.20 p.m. departures from and 10.40 a.m. and 6.38 p.m. arrivals at Marylebone which are the fastest and by far the most extensively patronised trains in the whole service.

Yours, &c.,

"VITESSE"

[Any such timetable reorganisation as those suggested might with advantage be carried out in conjunction with the L.M.S.R.—ED. *R.G.*]

PUBLICATIONS RECEIVED

A Hundred Years of Mechanical Engineering. By Edward Cressy. London: Gerald Duckworth & Co. Ltd., 3, Henrietta Street, Covent Garden, W.C.2. $8\frac{7}{8}$ in. × $5\frac{3}{4}$ in. × $1\frac{1}{8}$ in. 340 pp. Illustrated. Price 15s. net.—The term "mechanical engineering" is a comprehensive one, and when regarded from the point of view of a hundred years of progress, that comprehensiveness is increased, demanding a great deal of thought and care when undertaking a review of such a large subject covering such a long period of years. The author's aim, it is stated, is first to provide "an historical background for those who have just entered the profession of mechanical engineering; and secondly, to describe the more important departments and the relation of the whole to industry and public services." Though historical and explanatory in character, this new work is neither a history nor a text book, but seeks merely to survey on a broad canvas the main lines of progress in their contemporary as well as their historical aspects.

Viewed from this standpoint, the work would appear to fulfil its purpose admirably, and should therefore be welcomed as a serious and useful addition to literature on the subject with which it deals. It was a happy thought to choose for the titles of certain chapters, "The Engineer on the Road, —on the Railway, —at Sea, —in the Air, and —Underground," and we naturally turn to the second of these to discover the treatment accorded by the author to that phase of mechanical engineering with which we are most closely associated. As must be the case in any volume covering such a wide field, nothing more than a cursory survey of locomotive practice is, or could be, attempted in the seventeen pages allowed. But if, for the reasons given, the information is superficial, it strikes us as accurate, and free from the peculiar mis-statements of which writers treating the subject from the general viewpoint are so often guilty. Such matters as superheating, boiler pressures, and so forth, are disposed of in a few lines, and it is not particularly informative to say, as the author here does, that by superheating "the steam may be raised to a temperature of 200° F. or 300° F. above that of the boiler." It would have been more useful to give the actual superheat temperatures themselves, which are confined in normal locomotives within quite a limited range.

Again, in dealing with steam distribution valves, the book might lead the reader to believe that the flat or D type is relatively as common nowadays as the piston valve, which, as we know, is very far from being the case. Poppet valves are dismissed in less than two lines, receiving indeed only the barest mention. Nothing is said by the author about the activities of mechanical engineers on railways apart from locomotives, whereas, in point of fact, they have many other calls upon their attention in the designing and operation of machinery of various kinds, which are quite outside the functions of a "locomotive" engineer in the strict application of the term.

In making these few comments, we are not unmindful of the author's main purpose, and the difficulty he must have had in compressing such a large amount of information within the 340 pages.

The work can be recommended to all interested in mechanical engineering and its developments over a century. The publishers have done their part well, the text, illustrations and binding leaving nothing to be desired.

Compressed Air in Bridge Construction.—This brochure, reprinted from *Compressed Air Engineering*, and compiled by Mr. Andrew Stewart, M.Inst.E.E., describes many of the largest bridges built in recent years, and the use to which air plant has been put in the course of their construction. The particular tools referred to are the Boyer riveting hammer, force blower, wood borer, circular saw, etc., of the Consolidated Pneumatic Tool Co. Ltd., as used on the Sydney Harbour, Lambeth, Zambesi, San Francisco-Oakland, Hell Gate, Triboro, Chelsea, Buffalo River (East London, S.A.), Newcastle-on-Tyne arch, El Butana and Khartoum (Nile), Storstrøm, and Birchenough bridges. But the general construction and other features of these structures are also described and illustrated by excellent diagrams and photographs. The whole brochure is well produced and forms a most interesting pictorial and textual record of modern bridge construction work. Road work in the form of viaducts is also touched upon, and the various types of Boyer tool are illustrated and described.

The Official Guide of the Railways and Steam Navigation Lines of the United States, Porto Rico, Canada, Mexico and Cuba. 10 in. by 7 in. 1,560 pp. The National Railway Publication Company, 424, West Thirty-Third Street, New York. Price $2 monthly.—Those who tear their hair over the complexities of Bradshaw's Guide, would be forced to considerably severer expedients were they compelled to hunt up their trains in a timetable of such formidable dimensions as this 1,560-page American monthly volume. Yet it is a compilation of immense value, for it collects within one cover details of the train services of the whole of the railways contained within the borders of the North American Continent. Each issue opens with an index of more than 1,300 American transportation companies, followed by a similar index of some 400 steamship lines. Then follow 1,260 pages of timetables, and the final 270-odd pages are occupied with a complete list of American railway stations, including all those which, in order to keep the size of the guide within bounds, are not actually shown in the tables. A mass of information is given, including complete lists of all the principal officers of each railway, full details of all Pullman sleeping, parlor car and restaurant accommodation on all trains that carry it, and a miscellany of other facts, which make every issue in effect a gazetteer of considerable value for reference purposes, as well as being a timetable. The Official Guide, which is published monthly, is now in its seventieth year of appearance.

Volume Fans.—A catalogue has reached us from Keith Blackman Limited, 27, Farringdon Avenue, E.C.4, listing the various types of Blackman fans for ventilation, drying, fume and steam removal, and similar purposes. Protected, flame-proof, and totally enclosed motors are fitted, for use on d.c. or a.c. circuits, and the catalogue also lists starting and regulating switchgear for both types. Folding tables give full details of the dimensions, capacities, and prices of all fans, and in conjunction with the useful notes accompanying the illustrations make the catalogue a useful guide to the selection and purchase of fan equipment.

Electro-pneumatic Point Operation and Colour-Light Signalling at Leeds New Station, L.N.E.R. 20 pages, $8\frac{1}{2}$ in. × 11 in., 30 half-tone illustrations and one folding diagram. Text reprinted from THE RAILWAY GAZETTE for July 3, 1936, and April 23, 1937. Issued by the Westinghouse Brake & Signal Co. Ltd., 82, York Road, London, N.1.—This publication gives an excellent general account of one of the most important British signal installations of recent years, constructed on the relay, or circuit, interlocking principle and making use for the first time for a long period on main lines in this country of the electro-pneumatic system of point operation for new work. For these and other reasons the information given is unusually interesting. The advantages of the electro-pneumatic system appear to be once again claiming attention, in spite of the popularity, enjoyed uninterruptedly for so long, of all-electric apparatus. The results consequent upon its adoption at this busy station will certainly command attention. This installation is also the first large one here to have the panel system of control in place of the conventional power locking frame, and in view of the selection, recently announced, of the same apparatus, with the addition of the route-setting principle, for York, this description of the working at Leeds should be of particular value to operating officers. The illustrations have been carefully chosen to show every leading feature of the work. Printing and paper are alike excellent, and all who are interested in modern methods of signalling and handling traffic may with advantage add this booklet to their libraries.

THE SCRAP HEAP

After an educational visit to the Southern Railway train ferry dock recently, a letter was received addressed to " The Headmaster of the Southern Railway." Is this a forecast of a new grading?

* * *

The directors of the Eastern Counties Railway having conveyed, free of charge, 99 of the German emigrants shipwrecked in the *Burgundy*, off Harwich lately, have received a letter from the Consul-General of Saxony and the Hanse Towns, expressing his gratitude for this liberality, an act, he says, of friendly sympathy, which will be sincerely felt and appreciated by their countrymen in Germany and in every part of the world.—*From " The Illustrated London News " of December* 9, 1848.

* * *

I see that London Transport is spending £200,000 on making the tube railways " practically soundless." We shall all be very grateful for that; but something should be done also to curb those assiduous servants of the L.P.T.B. whose job it is to bay " Hurry on there " and " Further down the car, please," at our cringing shanks. The board will say that the public must be made to step lively, and I agree. Londoners loath stepping lively. *En masse* they are the slowest-moving people in the world. But can speed be imparted to our feet only by ravaging our nervous systems? Quite seriously I should like to suggest to the L.P.T.B. that they should experiment by fitting one or a couple of stations with a " golden voice," such as that which comes into action when you dial TIM, and which would automatically exhort us as the train pulled in. Personally I would show far more alacrity at the bidding of that siren voice than I do at commands uttered in the tone of a company sergeant with a batch of recruits.—*Peter Simple in " The Morning Post."*

* * *

Headed " South Western Railway—Instruction No. 294," an interesting notice originally exhibited at Dorchester over 50 years ago has recently come to light. The wording is as follows:—

WIMBORNE AND BOURNEMOUTH WEST LINE

To Enginemen, Guards and all concerned

ON MONDAY, JUNE 30th

And following Days until further notice

After the passing of the 9.37 p.m. Train from Wimborne to Bournemouth West the Signal Fitters will be engaged in altering the locking and point connections at the New Poole Junction Signal Box. During the time the work is in progress Drivers of all Trains and Light Engines must approach the New Poole Junction Station cautiously, at reduced speed, and must keep a good look-out for Hand-Signals, so as to be prepared to stop DEAD should a Danger Signal be exhibited. Inspector WILLS will be in charge of New Poole Junction during the time the work is in hand.

Waterloo Station. BY ORDER.
June 28th, 1884.

Attached to the board on which this notice was exhibited was also one relating to signalling regulations bearing the names of G. N. Tyrrell, Great Western Railway, and E. W. Verrinder, South Western Railway, but the wording has become undecipherable.

LOCAL RAILWAY SPEEDS IN 1867

In addition to the table of speeds of express trains (reproduced in our issue of September 24), *Engineering* for July 19, 1867, gave the following details of what it termed " Circular Metropolitan Railways," namely, those with services having both termini in the central area:—

Name of Town	Miles	Hr. Mn.	M.p.h.
Crystal Palace			
London Bridge to—			
Victoria (express)	17	0 35	29·2
,, (stopping)	17	0 55	18·5
North London			
Broad Street to—			
Camden (express)	5	0 13	23·1
Kew (stopping) ..	15	0 48	18·7
Chalk Farm (stop)	5¾	0 25	13·8
South-Western			
Cannon Street to Kensington ..	8½	0 27	18·9
Chatham and Dover			
Ludgate Hill to—			
Victoria (express)	7¼	0 28	15·6
,, (stopping)	7¼	0 37	11·8
South London			
London Bridge to Victoria	8½	0 35	14·6
Metropolitan			
Moorgate Street to—			
Hammersmith ..	7¾	0 37	12·6
Bishop's Road ..	4½	0 22	12·3

These interesting posters, for which we are indebted to " Pennyfare," were published about 1909. They were discovered in an excellent state of preservation at Earls Court beneath a number of commercial advertisements, when a hoarding was pulled down recently

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

ARGENTINA

The Railway Unions and the Presidential Award

For some time past, the two railwaymen's unions, the *Union Ferroviaria* and *La Fraternidad*, have been pressing for the cancellation of the Presidential Award of October, 1934, establishing the principles to be applied to wage reductions and short time—with a view to alleviating the financial situation of the companies—on the ground that the conditions which then rendered these measures necessary, no longer exist. Needless to say, the companies are unable to accept this view, having regard to the fact that the improved working results recorded during the financial period ended June 30 last are more apparent than real, the increased gross receipts as the result of heavier traffics having been seriously reduced and in some cases almost entirely wiped out by the losses on exchange.

The Companies' Reply

The companies replied to the men's protest by a joint note to the Government, expressing their surprise at the attempt on the part of the unions to coerce them into repudiating the Award, which had been accepted by both parties as a final legal decision, and had, as a matter of fact, been in some ways more favourable to the men than to the companies. They pointed out that the amount disbursed in salaries and wages still represented practically the same percentage of the gross receipts (more than half) as during the prosperous period prior to 1930, in spite of the serious decline in revenue since that year. Moreover, the Award explicitly declared that the deductions were to be regarded as temporary retentions, to be returned as soon as the financial situation permitted, which, in the case of most of the companies, had already been done, although in some cases, this was not entirely justified by the circumstances. Furthermore, in the event of the present higher receipts not being maintained, the companies might be again compelled to invoke the provisions of the Award authorising them to reapply the wage deductions, unless any future diminution of revenue was offset by an improvement in the exchange situation. On all grounds, therefore, they were unable to acquiesce in the men's demand for the cancellation of the Award.

By way of protest against the continued application of the terms of the Award, the unions instructed their members to stop work for five minutes, between 9.30 and 9.35 a.m., on August 20, on all the lines except the State, Buenos Aires Provincial, and Midland Railways. This action, which was more in the nature of a moral gesture, in order to call public attention to their protest, than inspired with the intention of interfering with the train services, was carried out without incident, normal working being immediately resumed. The question is now to be discussed between the representatives of the railway companies and the unions.

INDIA

New Express Service between the Punjab and the Sind

A new service each way between Karachi and Lahore, to be known as the Sind Express, will be inaugurated by the North Western Railway on October 1. The new trains will balance the Karachi Mail workings, and will run at practically the same speeds; but whereas the mail trains leave Karachi for Lahore in the evening and Lahore for Karachi in the morning, the Sind Express will leave Karachi about 8 a.m., and Lahore about 8 p.m. The new service is being introduced at the request of the Karachi Advisory Committee, and will, it is hoped, relieve the congestion in the mail trains, some of the heaviest and fastest in India.

Adjustment of Railway Rates and Fares

Replying to a question in the Assembly, Sir Sultan Ahmed informed the House that the question of improving railway finances by adjustments of rates and fares was constantly under consideration. The feasibility of an all-round increase to meet the rising costs of operation due to recent increase in commodity and coal prices was under examination.

Puja Holiday Concessions

All three major railways in Calcutta have notified liberal concessions for travel during the Durga Puja holidays in October. The Bengal-Nagpur Railway offers a return ticket for 1¼ single fares for first, second and inter class passengers, while third class return tickets are available at a fare and a half. On the East Indian and the Eastern Bengal Railways, first, second and inter class tickets will be available at 1⅓ single fares. The concessions are in all cases subject to certain distance limits. The concession rate for third class passengers varies on the E.I.R. from 1⅔ to 1⅓ single fares, according to the distance, and on the E.B.R. third class Puja concession tickets will be available at 1⅔ the single fare for the double journey. In addition, the E.B.R. will again issue the popular "travel-where-you-like" season tickets available for 15 days over the entire railway at the following rates: First class Rs. 60; second class Rs. 40; inter class Rs. 15; and third class Rs. 10. The Assam-Bengal, Bengal Dooars, and Darjeeling-Himalayan Railways, and the steamer companies, have agreed to join the Eastern Bengal Railway in the issue of Puja concession return tickets in through bookings from September 28. The Calcutta railways also offer substantial concessions for the transport of motorcars belonging to the holders of upper class concession tickets.

CANADA

C.P.R. Diversion in the Rockies

Near Alberta Canyon Gorge halt, on the C.P.R. line through the Selkirk Range of the Rockies, a 2½-mile length of line that is particularly vulnerable to snow and rock slips, is to be replaced this autumn by a new and safer section of line. Many lives have been lost and large sums of money have been spent in clearing the existing line at this point, and the $250,000 to be spent on the diversion are considered well worth while.

UNITED STATES

New Trains

The Southern Pacific has received from the builders two streamlined trains for service between Dallas and Houston. These trains will be drawn by steam locomotives which the railway is building in its own workshops.

On September 15, the Chicago & North Western, the Southern Pacific, and the Union Pacific placed in daily service a new Challenger train between Chicago and San Francisco, similar to the highly successful train of the same name and class which these railways have been operating between Chicago and Los Angeles [and which we described in our issue of September 24.—ED. *R.G.*]

Wage Parley Deadlocked

The railways, which last month granted a wage rise of 2½d. an hr. to all employees excepting train staffs, have definitely refused to grant the increase of 20 per cent. demanded by the train service unions, for reasons explained in these columns in THE RAILWAY GAZETTE of September 10.

They also point out that the increase in railway traffics is now less than 5 per cent. over last year, whereas receipts per ton-mile (by reason of the rate reduction enforced by the Interstate Commerce Commission at the beginning of the year) are about 5 per cent. less than last year. That is to say, the gross receipts are now probably only just about equal to those of last year, whereas prices of materials and taxes have increased considerably, hence they cannot afford a wage increase to their highest-paid employees

(many of whom earn upwards of £50 a month, some even more than £60).

BULGARIA

Railways and Harbour Finances and Development

The length of the Bulgarian State Railways at the beginning of 1936 was 2,794 km. of standard gauge and 410 km. of narrow gauge. According to the Report on Economic and Commercial Conditions in Bulgaria for 1935-36, issued by the Department of Overseas Trade, working results were as follow :—

	1936	1935
	(Thousand leva)	
Gross receipts ...	1,362,246 (£3,182,820)	1,214,793 (£2,838,300)
Expenditure ...	1,361,328 (£3,180,672)	1,206,869 (£2,819,787)
Passenger receipts...	395,600 (£924,300)	379,400 (£886,450)
Goods receipts ...	782,800 (£1,828,972)	784,300 (£1,832,477)
Number of passengers	7,866,200	6,937,900
Tons of goods ...	4,381,750	4,123,600
Wagons loaded ...	294,500	279,600

During 1936 a further 50 km. of standard gauge line were opened to traffic, the only section of international importance being the 33·5-km. line from Michailovo, on the Plovdiv-Stara—Zagova line, to Rakovsky on the main line to Istanbul. This new link shortens the journey from Roustchouk on the Danube, and hence Bucharest, to Istanbul by 128 km. In 1937 it is hoped to complete further new lines totalling over 100 km. The most important of these will be the standard gauge section of 33 km. from Doupnitza, south of Sofia, to Gorna Djoumaya in the Strouma valley. This new line, which will supplant the existing narrow gauge railway is a further link in the development of the through line from Sofia to the Greek frontier, and eventually to Salonica. During 1935–36, considerable quantities of new rolling stock were purchased, and services have benefited correspondingly. There has been extensive development in motor transport in Bulgaria, but the total number of motor vehicles in the country is still small.

POLAND

The State Railways in 1936

According to the Report on Economic and Commercial Conditions in Poland, issued by the Department of Overseas Trade in March 1937, the length of the railways worked by the State on December 31, 1936, was 18,191 km. of standard gauge and 2,413 km. of narrow gauge. Receipts for the 11 months January to November, 1936, amounted to Zl. 754,523,000 (£29,267,700 at average mean rate of 25.78 Zl. = £1), compared with Zl. 817,321,000 (£31,703,700) in the same period of 1935, while expenditure at Zl. 674,381,000 (£26,159,000) compared with Zl. 696,775,000 (£27,027,700). The decline in receipts was attributed mainly to the reduced freights introduced in December, 1935.

Motor bus services maintained by the railways show expenses for the 11 months amounting to Zl. 3,801,000 (£147,440) and revenue Zl. 3,764,000 (£146,000). The average total daily number of 15-ton lorries loaded in 1936 was 12,499 as compared with 12,191 for 1935, including 753 trucks in transit—as compared with 1,069 in 1935—and 170 from abroad.

Electrification of the State Railways and the fitting of air brakes to the rolling stock is proceeding steadily under contracts with British firms. There is a shortage of engines and carriages, which can, however, be met by local construction.

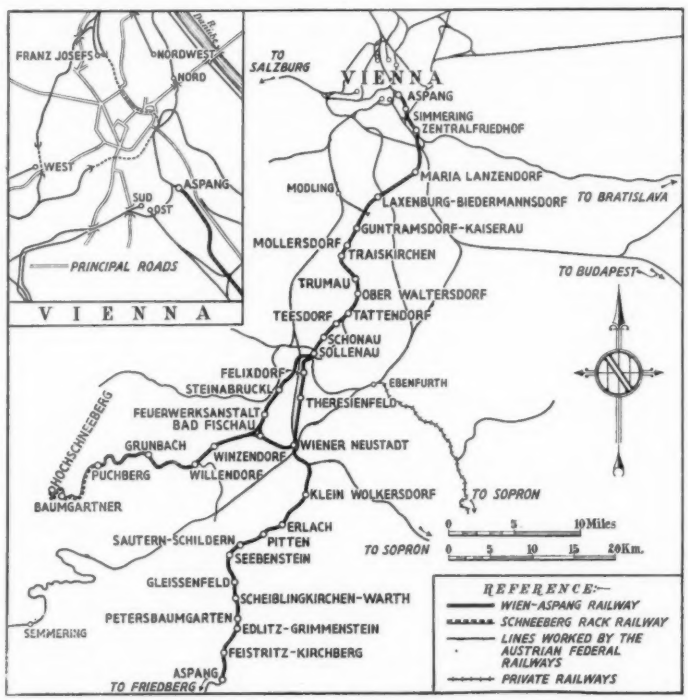
The Upper Silesia—Gdynia line, belonging to the Franco Polish Railway Company, which has been under the management of the State Railways for some years, will revert to the company as from January 1, 1938. Part of the French loan, *i.e.*, Zl. 136,000,000 (fr. 540 million) is contracted by this railway and will be used for the laying of a second track, provision of rolling stock, &c. The additional requirements of rolling stock for this railway are stated to be about 135 goods engines, 15 passenger engines and about 80 carriages, to an approximate value of 50 million Zloty (£1,940,000).

Much development is taking place in Polish land, sea and air transport and a substantial part of the National Development Fund will be spent on improvements in this respect during the next few years. During 1936, 131 km. of new railway lines were completed. A second track from Kutno to Torun was also completed. Some 275 km. of relaying were carried out and over 2,600,000 sleepers were replaced.

AUSTRIA

Vienna-Aspang Railway

Since July 1, the Vienna-Aspang Railway and the associated Schneeberg rack line have been worked by the Federal Railways administration [as recorded in the news columns of our issue of August 27.—ED. *R.G.*] The Aspang line is a 54-mile, standard gauge section with its own terminus in Vienna, situated not far from the Ost and Sud Federal stations. At Solleneau, 25½ miles from Vienna, a 44-mile branch runs to Puchberg, there to connect with the rack railway up to Hochschneeberg; the latter line climbs 4,150 ft. in six miles.



Sketch map showing the Vienna-Aspang Railway, branches and connections; site of Vienna terminus can be seen in the inset

Train Services

The train service to Aspang consists of ten trains each way daily in summer and eight in winter, there being nine and eight over the branch during these seasons respectively; through carriages are run from Vienna to Puchberg on all branch line trains. Other through carriages are attached to three of the summer Aspang trains for the mountain resort of Bad Tatmannsdorf, and in winter three trains have through services via Aspang, the Federal Railways, and Fehring for Graz.

AN EARLY RAILWAY SHARE CERTIFICATE

(From a correspondent)

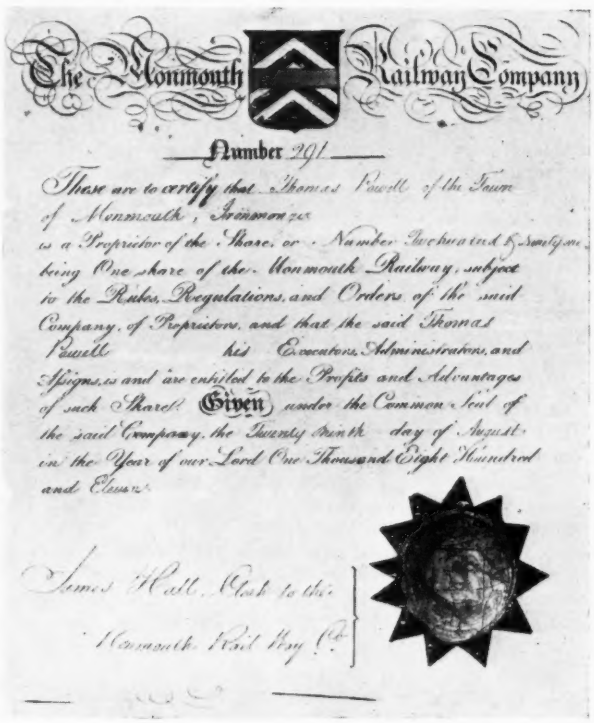
SHARE certificates of very early railways are extremely rare, as most of them were cancelled or destroyed many years ago.* It is, therefore, of interest to be able to reproduce a Monmouth Railway share ticket or certificate of 1811. This certificate is printed on the first of a four-page sheet, 10 in. by 8 in., and across the top in Old English characters and with a large number of graceful flourishes appears the title "The Monmouth Railway Company."

In the centre of the words, emblazoned in colours, is shown the company's coat-of-arms. Heraldically this may be described as Azure, three chevronels Or, over all a fesse Gules. In modern language this means a shield of a blue ground or field on which are placed three chevronels of a gold colour, while superposed is a red fesse or horizontal band across the centre. Actually the town of Monmouth has no armorial bearings which are recognised by the College of Arms or Heralds' College, and the seal that is employed by the Corporation represents an ancient ship; but Burke, a recognised authority, gives the arms quoted above as being in use, so it will be seen that the railway appropriated the design used by the town. The three chevronels appear also in the shields of the Cardiff and Rhymney Railway Companies, but without the fesse which occurs in the Monmouth coat-of-arms.

Then follows in Old English lettering "Number 291," and in script characters the text of the certificate. It is to be noted that the clerk prefers to write Rail Way rather than Railway, though the certificate itself uses the latter form. The seal of the company in red wax is placed on a twelve-pointed star of black paper and attached to the lower right-hand corner of the document. On a shield the coat-of-arms is reproduced, and as colours are not possible in a monochrome medium, the seal engraver has employed the shading that is usually adopted in such cases to denote colour. Thus horizontal lines indicate blue, small dots gold, and vertical lines red. In the band or garter round the seal occur the words in capitals: "The Seal of the Monmouth Railway Company."

Early last century three railway or tramway companies were formed to convey minerals and timber from the Forest of Dean, namely, the Bullo Pill, from the River Severn near Newnham into the Forest of Dean; the Lidney & Lydbrook (which afterwards became the Severn & Wye), from the Severn at Lydney to the Wye at Ruardean; and the Monmouth. The first two obtained their Acts of incorporation in 1809.

On May 24 of the following year (1810) the Monmouth Railway Company was authorised to construct a tramway and branches passable for wagons or carriages from Howler Slade near Cinderford through the villages of Newland and Redbrook and the town of Coleford to May Hill near Monmouth, a distance of some eight or nine miles. The crossings over the river Wye were to be made by means of a barge drawn by a chain. The company had power to set out "Proper places for Waggons and Carriages to turn, lie, and pass each other" thus showing that only a single line was intended to be laid. This was really a plate-way, as the metals were iron plates made of L section, and unflanged truck wheels ran upon the base of the plates, the upright portion keeping the wheels on the track. It was stipulated that the flange was not to exceed one inch in height at places where a public road was crossed on the level.


The Monmouth Railway Company

Number 291

These are to certify that Thomas Powell of the Town of Monmouth, Ironmonger is a Proprietor of the Share or Number Twelve and Fifty one being One share of the Monmouth Railway, subject to the Rules, Regulations, and Orders of the said Company, of Proprietors, and that the said Thomas Powell his Executors, Administrators, and Assigns, is and are entitled to the Profits and Advantages of such Share. Given under the Common Seal of the said Company, the Twenty Ninth day of August in the Year of our Lord One Thousand Eight Hundred and Eleven.

James Hall Clerk to the Monmouth Rail Way Co.

Railway share certificate issued in 1811

One interesting provision in the Act was that "no unauthorised person shall ride, lead, or drive upon the railway or cause or suffer it to be done by others, any Horse, Mare, Gelding, Mule, Ass, Cow, Neat Cattle, Sheep, Swine, or they shall forfeit and pay unto the Company any sum not exceeding forty shillings." Another was that "every owner of any wagon or carriage passing along the railway shall cause his name, place of abode, and number of the vehicles to be printed in large white capital letters and figures on a black ground three inches high at least."

The Act of incorporation required the common seal of the Monmouth Railway Company to be affixed to every ticket or instrument specifying the shares to which the proprietor was entitled, he paying the clerk to the company "one shilling and no more for every such ticket." Our illustration therefore shows the ticket and the common seal for which Mr. Thomas Powell had the privilege of paying one shilling. On the back of the certificate appear in ink the following words:—

Stroud July 31st. 1849.

Thos. Gratrex Esq.
Mr. Secretary,

SIR,—I shall feel obliged by your paying the dividend due on this share (to the bearer Mr. Lucas) which I received in part of Legacy left me under the Will of my Uncle the late Mr. Thomas Powell.

I am, Sir,
Yours respectfully,
MARY ELLIOTT.

Evidently in 1849 the Monmouth Railway Company was able to pay dividends.

* On page 724 of our issue of April 19, 1935, we reproduced a share certificate of the Surrey Iron Railway Company dated July 31, 1806, from the collection of Mr. John Phillimore.—ED. *R.G.*

AUTOMATIC SIGNALLING IN SWITZERLAND

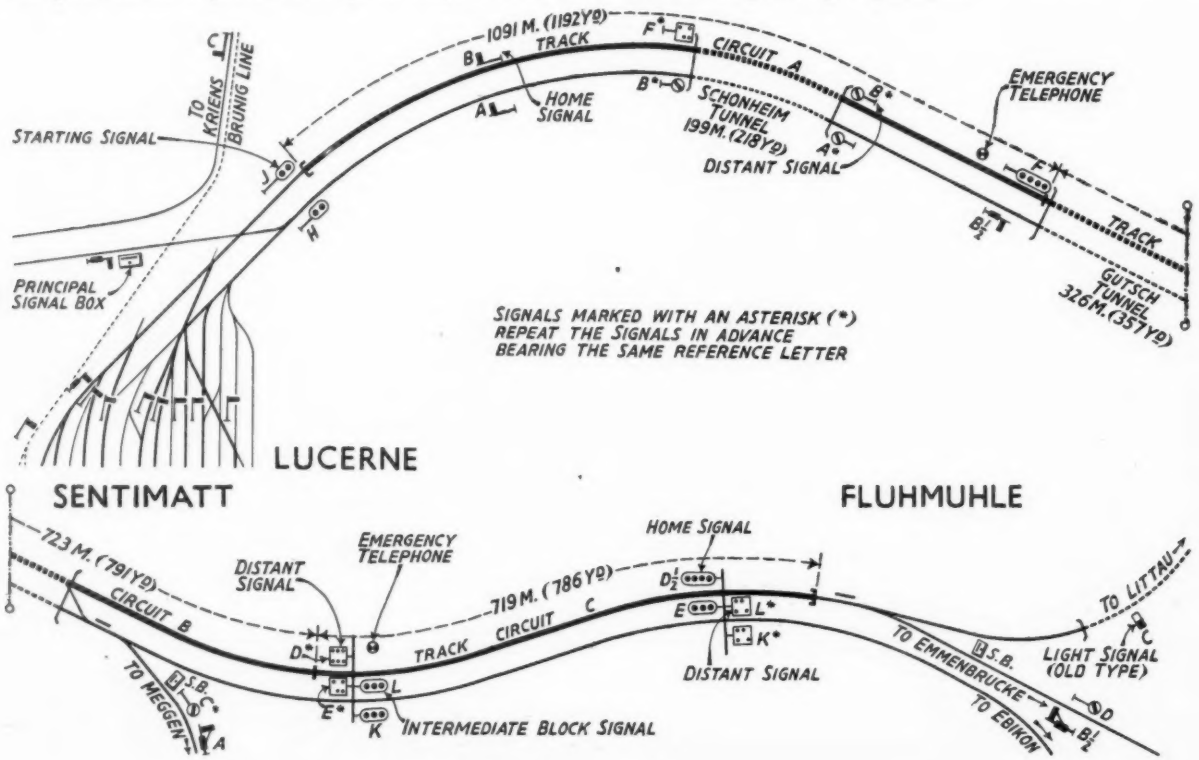
An interesting single line installation

THE accompanying diagram, taken from the official journal of the Swiss Federal Railways, shows an interesting section of line 2.7 km. (1⅝ miles) long, between Lucerne and Fluhmühle. It consists of two single lines side by side, passing through the Schönheim and Gütsch tunnels, and worked hitherto with the single-line block apparatus usual in Switzerland, operated by magneto-generator. Traffic on the upper track, leading to Littau and Emmenbrücke is at times fairly heavy, and when trains had to be duplicated, or were running late, it was found that the capacity of the single-line section, with its former system of signalling, was insufficient to prevent delays. It has accordingly been subdivided into track circuit sections, as shown, and resignalled, the alternating current block mechanism being modified to act as a direction selection and prevent two trains starting from opposite ends of the single line simultaneously, thus forming a sort of semi-automatic lock-and-block.

The track circuit sections are three in number, but the controls are combined, so that signal *J*, for instance, is governed by the condition of section *A*, and signal *F* by by that of sections *B* and *C*, for trains from Lucerne. In the reverse direction signals $B\frac{1}{2}$ and *C* at Fluhmühle are controlled by section *C*, and signal *L* by sections *B* and *A*. Every train has to be accepted by the signalman at the other end of the single line, the intermediate block signal working automatically, and what he has done, together with the progress of the trains, is shown by lamp indicators.

As the trains are propelled by single-phase alternating current, single-rail d.c. track circuits are used, fed from 12-V. batteries through regulating resistances, with protecting reactances to prevent damage or irregular influence from the traction current. Track circuit section *A* is 1,091 m. (1,192 yd.) long, *B* is 723 m. (791 yd.), and *C* 719 m. (786 yd.) long, the respective ballast resistances being 4, 5 and 7 ohms. The non-insulated rail is bonded every 200 m. (219 yd.) to the rails of the Meggen—Ebikon line, to augment the traction return. The intermediate signals are normally at danger, but clear for the direction concerned when the relative starting signal is cleared by Lucerne or Fluhmühle. All signals return automatically to danger when passed by a train, and no signal can be cleared again until that train has been correctly protected by the signal in advance. The majority of signals are of the colour-light type, the aspects according with those explained in the article in our issues of February 16, 1934, February 7, 1935, and October 30, 1936. Reserve red or yellow lights are provided to meet cases of failure.

An illuminated diagram is provided in the Sentimatt junction cabin, on which signals are repeated, while any failure is revealed by a continuously ringing bell. Other signals are repeated at Lucerne or Fluhmühle. Telephone communication is provided from signals *F* and *L;* in the case of any prolonged failure the single line is worked as one block section under special regulations. The construction of an additional track between Sentimatt and Fluhmühle is contemplated, and the gantries carrying signals, *L*, *K*, $D\frac{1}{2}$, and *E*, with relative distant signals, have been made wide enough to meet this. There are probably a number of single line sections in Switzerland where similar equipment might be used with advantage. The present work was carried out under the supervision of Messrs. Schaffer & Winiger, of the Lucerne (No. 2) Division, Engineering Department.



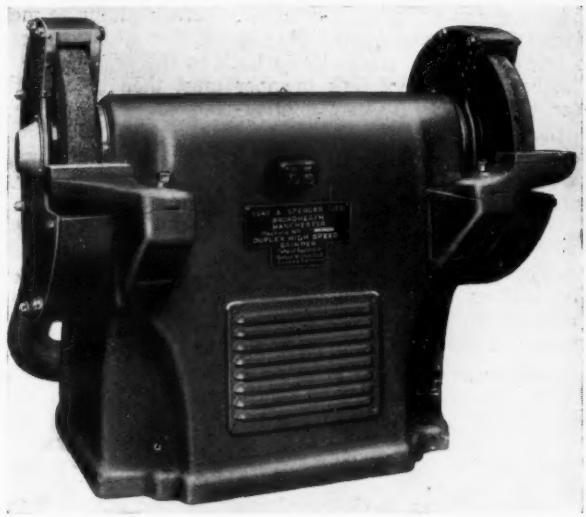
A NEW HIGH-SPEED GRINDING MACHINE

Duplex model recently introduced by Luke & Spencer Limited, Manchester

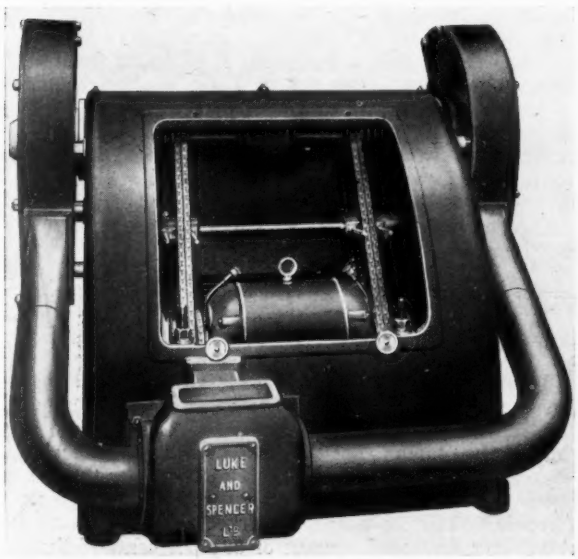
THE operation of grinding can be divided into two categories, precision grinding, and rough grinding or "snagging." Marked developments have been made in both, and in recent years many manufacturers of steel, malleable iron, and non-ferrous castings have adopted the new process of high-speed grinding, *i.e.*, running special synthetically-bonded grinding wheels of exceptional strength at 9,000-9,500 ft. per min., whereas the normal practice is for ordinary wheels to be run at 5,000 to 6,000 ft. per min. peripheral speed. Naturally the great increase in wheel speed gives considerably higher production.

It is well known that the durability of grinding wheels is sensitive to speed, and recent tests have shown that when a wheel, run at constant speed throughout its life, has nearly worn down to its clamping plates, the wheel loss per unit of work done is approximately 450 per cent. greater than when the wheel was at its original diameter. The new high-speed grinding wheels, being of very open structure, are extremely sensitive to this speed factor, and therefore nearly all high-speed grinding machines are fitted with a two- or three-speed change device, generally consisting of step-coned vee-belt pulleys on the motor and wheel spindle. However, it is an established fact in foundries that wheels even of the same grit and grade wear down at different rates, mainly owing to the different skill and strength of the operators, and variations in the severity of work.

In most cases the speed of a grinding machine spindle cannot be increased to bring the smaller wheel back to an efficient velocity without overspeeding the larger wheel, with grave risk of bursting. To overcome this disadvantage of heavy wheel loss and poor production, Luke & Spencer Limited, Broadheath, Manchester, has recently introduced the attractive and efficient duplex high-speed grinding machine illustrated herewith. Patents have been applied for in Great Britain, U.S.A., Canada, and Germany. This machine has two independent spindles which can be run at different speeds from a single motor in the base. Thus each wheel can be driven at the correct speed for its diameter, and the operator is compelled to make the appropriate changes as they become due. A highly efficient dust exhaust fan and system has been designed as a unit to fit on the machine when desired. The machine has a massive close-grained cast-iron body, designed to withstand the severe stresses of heavy grinding, clean lines and absence of pockets which might accumulate dirt. The front of the body is swept away for foot clearance, giving the operator a better grinding position, with safe foothold; also, the body is relieved in line with the grinding wheels to enable them to be worn down to the plates without the castings fouling the body.



General view of new machine



Cover removed showing belt drive from motor to spindles

The high tensile steel spindles are mounted on large size heavy barrelled roller bearings, and all roller bearings are protected with special modern grit seals. The spindles are driven from a single 7½-h.p. a.c. squirrel-cage, high torque motor, adjustably mounted for belt tensioning on the base in the body. The motor is fitted with an indestructible rotor, and a 75 per cent. starting torque is obtained with only 140 to 160 per cent. full load current. Under continuous full load conditions, the temperature rise is only 32° C., and only 40° C., (British Standard) on 25 per cent. overload for two hours. The motor spindle is provided with two driving ends, of equal diameters and load-carrying capacity, and the motor is guaranteed for seven years. Drive to the spindle is by duplicate vee belts. The work rests take the form of steel castings, fitted with special hardened pads. Three designs of pads are available, one plain type, one angle section, for light parts, allowing finger clearance, and one provided with a series of holes for poker application.

New type Borolite high-speed grinding wheels, of Luke

& Spencer manufacture, are provided for running at a peripheral speed of 9,000 ft. per min. These are of great strength, open structure, and fast cutting quality. Work rests are always kept close to the wheel to obtain efficient grinding and prevent accidents. In this machine each work rest is directly connected to a gate device inside the body of the machine. It is so arranged that the rest can advance only a certain distance at a time because of the steps in the gate, this distance corresponding to the diameter of the wheel when due for its first speed change to bring the peripheral velocity back to the original one. The belt interference fork member must then be moved over to the second-speed position and the belts placed in the second speed. This allows the rest to be moved forward as the wheel wears for another predetermined distance, when the same operation is again performed, thus compelling the belts to be placed in the third or highest speed, which again speeds up the periphery of the wheel to the original velocity. The last portion of the wheel can be worn down to the plates and the rest advanced as the wheel wears. By this arrangement the operators are compelled to increase the speed of their own wheel immediately it is due, thus ensuring the management of the greatest economy and maximum production. A new wheel cannot be mounted without first withdrawing the rest. This operation entails moving the interference fork member to its orignal position (first speed), and changing the belts also to this position, thus eliminating risk of a new wheel being run at too great a speed.

While this machine has been designed as a self-contained, motor-driven unit, it can also be supplied for belt-driving, at the same time retaining the special features of speed-changing, safety device, and dust exhaust. It is manufactured to carry grinding wheels 18 in., 20 in., and 24 in., dia., of various thicknesses up to 3 in. Cast iron can be ground about 300 to 400 per cent. faster than with normal speed machines, malleable iron and steel castings, forgings, &c., from 150 to 400 per cent. faster, and phosphor bronze has been removed at the rate of 50 to 60 lb. per hour. The new Luke & Spencer Borolite wheels are specially manufactured to maintain good square edges, and are assisted in this respect on the new duplex machine by the maintenance of a constant peripheral velocity of the wheel through its entire life. High pressure grease lubrication is used throughout.

A Black Country Chronicle

(*From a correspondent*)

IN Scotland, as in England, the rise of the railway industry coincided with the growth of what we have to call the Black Country. The Burgh of Coatbridge, a typical Scottish Black Country town, is familiar to many people, English and Scots, who nevertheless have never walked its grey, treeless streets. And Coatbridge, the heart of the Monkland, saw the beginnings of public railway operation in Scotland. We have seen Coatbridge, by night, in its palmy days, when the whole sky seemed to be set on fire by the blast furnaces. We have seen Coatbridge, a dead town, in 1932; and we saw it the other day from a southbound night train when, though the huge blaze of more prosperous years was still absent, the Gartsherrie ironworks at least gave forth a brave glare from their black yards.

And though there still is, or ought to be, a great sadness about Coatbridge, we are more than familiar with the cheerful family parties who pile into the third class carriages of the Royal Highlander at Perth, after a joyous day's escape into the hills, and pile out again on to the long dim platform that lies beyond the glowing blast-furnaces of Gartsherrie. One psychologist at least has explained how so many citizens of Coatbridge manage to keep their heads spiritually above water, and his explanation comes in the form of a history book ("Work and Prayer." By the Rev. William Hamilton, M.A., Coatbridge: Alexander Pettigrew Limited, 54, Main Street. 288 pp. Price 7s. 6d. net). Mr. Hamilton's rendering of the chequered history of Coatbridge makes really inspiring reading. One does not look for grandeur in a locally produced history of a provincial parish, yet here one finds it, a grandeur that more than reconciles even an agnostic reviewer to the book's austere title. It seems almost an impertinence to add that the book is beautifully produced and printed.

Though the backbone of Mr. Hamilton's story concerns his own church, that of Dunbeth, his book makes as fine a history of Coatbridge, its people, and its surroundings as is ever likely to be written. The history of the Monkland iron industry is all there, and in company with it the railway student will find a full—it almost seems a first hand account—of the coming of the Monkland & Kirkintilloch Railway in 1826. This opened up a line of communication with the Forth and Clyde Canal, and was eventually to become part of the North British Railway system. In 1831 came the Glasgow & Garnkirk Railway, later incorporated in the Caledonian. Times were already changing; the Garnkirk, which joined the Monkland at Gartsherrie, was in opposition to the Monkland Canal. Though Mr. Hamilton adds a year to the age of the Stockton & Darlington Railway, which in any case is outside his province, his dealings with the early Scottish lines are unblemished.

In the seventies came the Glasgow, Bothwell, Hamilton & Coatbridge Railway, sponsored behind the scenes by the North British, to compete with the firmly entrenched Caledonian. Incidentally, it required the site of a predecessor of Dunbeth church, so Mr. Hamilton not unnaturally gives a very complete account of the long negotiations which preceded the construction of the Bothwell line. The Glasgow, Bothwell, Hamilton & Coatbridge Railway, built under an Act of 1874, was amalgamated outright with the North British in 1879.

So the Minister of Dunbeth celebrates the centenary of his church by writing one of the most fascinating histories imaginable. *Laborare est orare* is the motto of Coatbridge, and the author quotes it at the head of his first chapter. The reader might add, at the end of the last, that this work is a prayer in itself.

AN UNWANTED CANAL.—The annual report of the Wilberfoss & Thornton Level Drainage Board refers to the offer of the L.N.E.R. Company to hand over the Pocklington Canal to the board as a drainage channel. The company was prepared also to hand over the freehold. The board, while of the opinion that the canal would undoubtedly be a benefit in flood times, was unable to consider the matter further until the canal had been put into a thorough state of repair. Had the board embarked upon a scheme for taking over the canal a grant of 33⅓ per cent. of the net cost would be available under a Government grant for drainage purposes.

TARIFF DISTANCES

In Continental timetables distances are given as a basis for calculating fares and therefore do not always correspond with geographical distances

By LIONEL WIENER

IN many European countries the kilometrages given in the timetables should not be used when calculating train speeds, because they are inserted for tariff purposes and do not always state actual distances. Such variations are due to four causes: the practical necessity of using round figures; compensation for costly engineering works; gradients, involving high working costs; and, lastly, alternative routes. Figures with decimals are not rounded to the nearest kilometre unit, whether above or below, but, in most Continental countries, as soon as any kilometre figure is exceeded, even by a single metre, an entire tariff-kilometre is added.

Compensation for Costly Works

As tariffs apply to entire railway systems, the prices paid for transport must leave a margin above average expenses, and not necessarily above expenses applying to any particular line. In spite of this general rule, extra prices are demanded when costly engineering works occur on a route, much as tolls used to be levied for crossing certain road bridges. But instead of these tolls being fixed charges, they are additions to the real distance of a certain number of virtual tariff kilometres. Thus, whereas the actual distance from Budapest (Keleti) to Kolenföld is 12 km., an extra 8 km. are added, bringing the total up to 20, for use of the 476-metre bridge across the Danube. In the same way, 6 km. are added for the Györ bridge. In France, when a junction was effected between the Midi and P.O. system, 5 tariff kilometres were awarded to help amortise the cost of the bridge over the Garonne (nearly 500 m.). Thus, though the distance from Angoulême to Bordeaux St. Jean is only 134.358 km., it is counted as 139.358 km., rounded up, as we have seen, to 140 km. The same applies to certain tunnels. The length of both the Lötschberg and Simplon tunnels is doubled for tariff purposes. But such tariff lengthenings may also proceed from other causes. Thus, though the length of the Ricken tunnel in Switzerland is virtually increased by 60 per cent., this is not because of its cost as a tunnel, but because of operating expenses (as we shall see later), the gradient being 1 in 53.

Other similar tariff lengthenings are temporary, and authorised only until amortisation, total or partial, has been effected. The alterations at Nantes now in progress on the Paris-Le Croisic line are an instance. In compensation for the fr. 30 million which the P.O. company had to advance (and which were to be recognised as capital outlay) it was entitled to add 4 tariff kilometres to a number of fares for journeys *via* Nantes (Convention of November 10, 1933). But as soon as the extra taxation levied by the Nantes Chamber of Commerce to finance its own works in connection with those of the railway Decree of January 29, 1935, of which the maximum duration is 30 years, ceases, the 4 extra tariff kilometres are to be dropped.

Gradients

A line whose gradients are double those of another may be a good deal more than twice as costly to work, so the idea of applying higher tariffs to it is a sound one. Otherwise, though its smaller mileage may entail a lower building outlay, it is more difficult to remunerate expenditure on a kilometre basis as profits are necessarily less. When this question was first investigated it was generally deemed advisable to consider the necessity for additional tariff kilometres as applying to so-called mountain railways only, and for gradients over 15 mm. per m. (1 in 66·6).

se tariffs seem to have originated in Switzerland, and to have been used shortly afterwards in Austria, and then in the Balkans, to the railways financed by Baron de Hirsch's Austrian capital. Only in Switzerland have they been systematically applied. A Decree of the State Council (September 11, 1873) recognised that heavy-gradient railways were more costly to operate and that the companies working them should be entitled to use higher tariffs which would enable them not only to cover this extra expense but also to remunerate their capital. When balancing receipts and expenses, both should be increased, the former by means of these higher tariffs, the latter, virtually. To accomplish this, it was estimated that one half only of the actual expenses (fuel, lubrication, upkeep, brakemen, &c.) varied with the gradients, the other half (overhead charges, dispatching, telegraph, &c.) remaining constant. Thus fixed expenses should always be taken as 0·50, and the other increased with the gradient. The sum of the two was to be further increased so as to provide for capital charges, as follows:—

	Gradients up to			
	1 in 100	1 in 66·7	1 in 50	1 in 20
Estimated fixed expenses	0·50	0·50	0·50	0·50
,, variable expenses ..	0·50	0·69	1·12	2·50
Total operating expenses..	1·00	1·19	1·62	3·00
Total operating expenses, including capital charges	1·00	1·38	1·80	5·00

There was no reason to consider gradients heavier than 1 in 20, and it will be noted that for these exceptional gradients, expenses are estimated at five times those of level lines.

On June 27, 1901, a further law empowered the Commission for Supervising Railways to validate virtual tariffs when special conditions existed either in construction or in operation. As a matter of fact, these tariffs no longer follow strict rules, though some endeavour has been made to apply similar virtual tariffs to similar lines. Thus on the Rhaetian Railway, they add, according to the sections, 33·3 or 66·6 per cent. to the actual distances, whereas on the Bernina the lengthening is equal to 25 per cent. only, and on other lines to 20, 40 or 60 per cent. for gradients of 1 in 33·3, 40, or 53, whereas the exact reverse might be expected, the steeper lines being seemingly entitled to the greater virtual lengthenings.

Virtual tariff distances have been done away with for goods traffic, and on some lines passenger virtual tarification differs according to class. Thus on the stiff 10·8-km. section of the Brünig Railway, the increase is 16 km. in first and second class and 21 km. in third class. Luggage virtual distances differ again, and usually more so than do passenger distances. On rack railways they are frequently as much as 10 times the distance (Arth-Rigi, Naye, Pleiades) and sometimes even more (the 2 km. of the Brunnen Railway become 30; the 9·4 of the Jungfrau, 240). This is done, of course, to discourage this class of transport save when absolutely indispensible, and then to make it pay.

Austrian tariff distance increases were embodied in a law of June 15, 1877, completed, as in Switzerland, by a

more recent one, of May 25, 1890. The length of sections where gradients were heavier than 1 in 66·7 were to be virtually increased by amounts varying from 150 per cent. down to 50 per cent. and that independently of the severity of the gradient itself. Thus on the old Sudbahn's Vienna-Murzzuschlag 117-km. stretch, there are 25 actual km. with these heavy gradients, and 37·5 (150 per cent.) are added to the distance. On the other hand, on the Innsbruck-Bludenz 136-km. section, though there are 47·5 km. of heavy gradients, 23·7 km. only (or 50 per cent.) are added, bringing the totals up to 154 tariff km. in the first instance and 160 in the latter.

In the Balkans, tariffication obeys the clauses of the Vienna Four Power Convention (May 9, 1883) which elaborated those of the Berlin Treaty of 1878. Real tariff distances applied only to sections where gradients were not steeper than 1 in 100. Virtual distances applied beyond that figure, and a new element, curvature, was introduced. Virtual distances took curvature into account whenever the radius was shorter than 600 m. Thus virtual tariff distances applied very nearly to the whole railway system. The limit of virtual lengthening, however, was fixed at 100 per cent.

Apart from the countries quoted, virtual distances are exceptional, and there are but two instances in France, both applying to metre-gauge lines. On the Le Fayet-Vallorcine section of the P.L.M. 100 per cent. lengthenings apply to all tariffs, both passenger and goods. On the P.O.-Midi, the Villefranche-La Tour du Carol section, with gradients of 16 mm. per m. and more, the same lengthening applies between Olette and Bourg-Madame, and thence to La Tour du Carol it is 75 per cent. for goods and 50 per cent. for passengers.

Alternative Routes

As a general rule, in the case of alternative routes the tariffs used are those applying to the shortest. But in the Mitropa Kursbuch (railway guide), at the head of the station index (wherein distances between important centres are shown), is found this somewhat perplexing note: "The figures . . . indicate the distances in tariff-kilometres. The tariff-kilometre figures do not always agree with the distances in kilometres shown in the timetables." Thus the distance from Berlin to Breslau is solely quoted as 336 km., which is the distance by the shorter Frankfort-on-Oder route, though it is 412 km. by the longer Hirschberg one. This is usual. But on the other hand, the distance from Berlin to Bremen is 339 km. *via* Uelzen. Yet, instead of using the same distance by the alternative routes, 378-km. tariffs are charged *via* Hanover and 394 *via* Hamburg. It might be supposed that this is due to the relatively large difference in mileage. But even this is not the case, as the distance from Saarbrucken to Coblenz is given as 201 km. *via* Treves and 204 *via* Bingerbruck. It is possible that the conditions applying to lines taken from obsolete companies account for these discrepancies.

Cases of tariff distances shortening instead of lengthening actual distances are exceptional. We quote as examples two instances accruing from different principles to be found on the same system, the P.O.-Midi of France. The Bordeaux terminus of the Arcachon line was originally at Ségur. In 1855 this station was suppressed and the railway extended two kilometres to Bordeaux St. Jean, it being specified (Decree of April 14) that tariff-distances to Bordeaux St. Jean should not take any account of the two extra kilometres of railway. Thus all distances from Bordeaux St. Jean to stations on the Arcachon line, such as Facture, Lamothe, &c., are really 2 km. longer than is shown in the timetables (the distance to Lamothe, for example, is given as 40 km. when it really is 42). Curiously enough, when proceeding north of Bordeaux, the distances from stations of the Arcachon line are actual and not virtually shortened distances.

The second instance is more curious still and concerns the so-called "Lodève constants." A branch of the Tournemire-Bédarieux Railway runs in a large semi-circle to Lodève, which is thus at no great distance from the main line. The Midi Railway was to connect Lodève with Ceilhes-Roqueredonde station on the main line by a 47-km. link, but obtained an annulment of this obligation. In exchange for the economies thus realised, it was decided that passengers from stations of the existing Bédarieux-Lodève branch travelling by the roundabout route to Tournemire or beyond should pay, instead of actual distance tariffs, a fixed sum corresponding to a distance of 70 km. travel, whether starting from Lodève (real distance, 118 km.), Rabieux (105), and so on down to Gabian (71).

The Maenclochog Railway

Owing to the heavy decline in local traffic, the passenger train service between Clynderwen and Fishguard *via* the Rosebush and Letterston line was withdrawn by the G.W.R. on Monday last, September 27, with the introduction of the winter timetable.

Although the stations at Llanycefn, Maenclochog, Rosebush, Letterston, and Puncheston are closed to passengers, facilities continue to be afforded for parcel, mineral, livestock, and other descriptions of merchandise business; the halts at New Inn Bridge, Castlebythe, Martell Bridge, and Beulah are closed entirely. This Pembrokeshire line —often called the Maenclochog Railway—had its beginning on June 24, 1872, when a Certificate of the Board of Trade authorised Mr. E. D. T. Cropper of Penshurst, Kent, to construct a railway 8½ miles long from Narberth Road station (later named Clynderwen) on the G.W.R. to some quarries of his at Rosebush near Maenclochog. Passenger traffic was inaugurated on September 19, 1876. The Rosebush & Fishguard Railway Company was formed by Act of August 8, 1878, for the purpose of continuing the line to Fishguard, and on August 11, 1881, it was authorised to absorb the Narberth Road and Rosebush section. Beyond constructing about a mile of line from Rosebush, the new company accomplished little and on December 31, 1882, the Maenclochog line was closed. The company's name was changed to the North Pembrokeshire & Fishguard Railway by an Act dated August 7, 1884.

The concern then remained moribund for ten years. In 1892 it became closely related with the Fishguard & Rosslare Railways and Harbours Company and work was put in hand for reconditioning and extending the line. The Narberth Road and Maenclochog section together with an extension of 9 miles to Letterston was opened for goods on March 14 and passengers on April 11, 1895. The North Pembrokeshire & Fishguard Railway was vested in the G.W.R. (from February 12, 1898) and this was confirmed by Parliament on June 20, 1899. The line from Letterston to Fishguard & Goodwick station was opened on July 1, 1899, but a new link between Clarbeston Road and Letterston was brought into use on August 30, 1906, when the Fishguard-Rosslare steamer service was inaugurated, so that the old Maenclochog Railway never formed part of the new route to Ireland.

THE WEST RIDING LIMITED

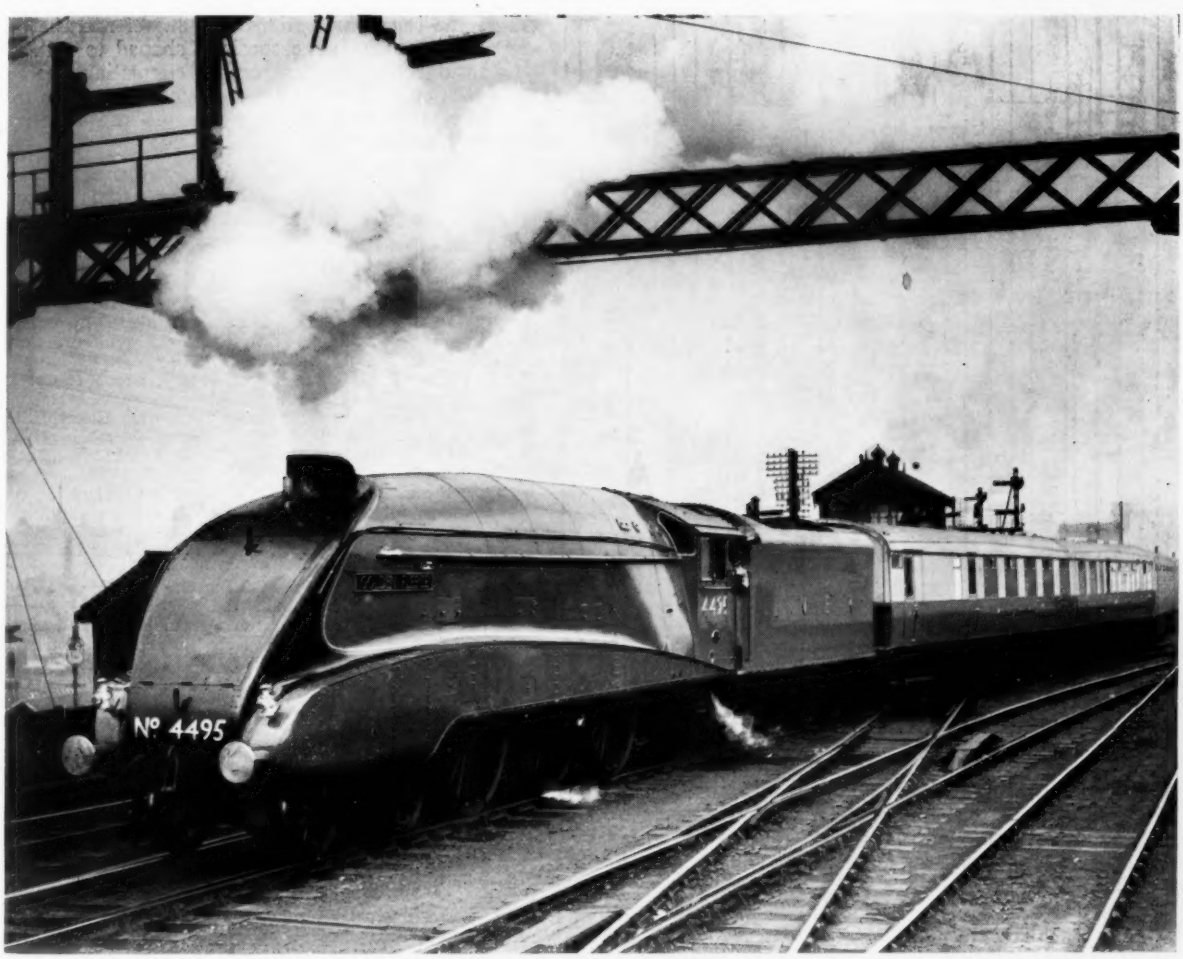
New streamlined trains for high-speed London–Leeds–Bradford service, L.N.E.R.

FOR the new high-speed London—Leeds—Bradford service inaugurated last Monday and described on page 571, the L.N.E.R. has built completely new rolling stock to the designs of Sir H. Nigel Gresley, Chief Mechanical Engineer. Two new streamlined Pacific locomotives Nos. 4495 and 4496, *Golden Fleece* and *Golden Shuttle* respectively, allocated to this service are similar to the "Silver Link" type built for the Silver Jubilee service between London and Newcastle introduced two years ago. They have 6 ft. 8 in. coupled wheels, three 18½ in. × 26 in. cylinders, and work at a pressure of 250 lb. per sq. in. Of the combined heating surface of 3,325 sq. ft., the superheater contributes 949 sq. ft. The grate area is 41·25 sq. ft., and the tractive effort (at 85 per cent. b.p.) is 35,455 lb. The corridor tender carries 8 tons of coal and 5,000 gallons of water, and the total weight of engine and tender in working order is 167 tons.

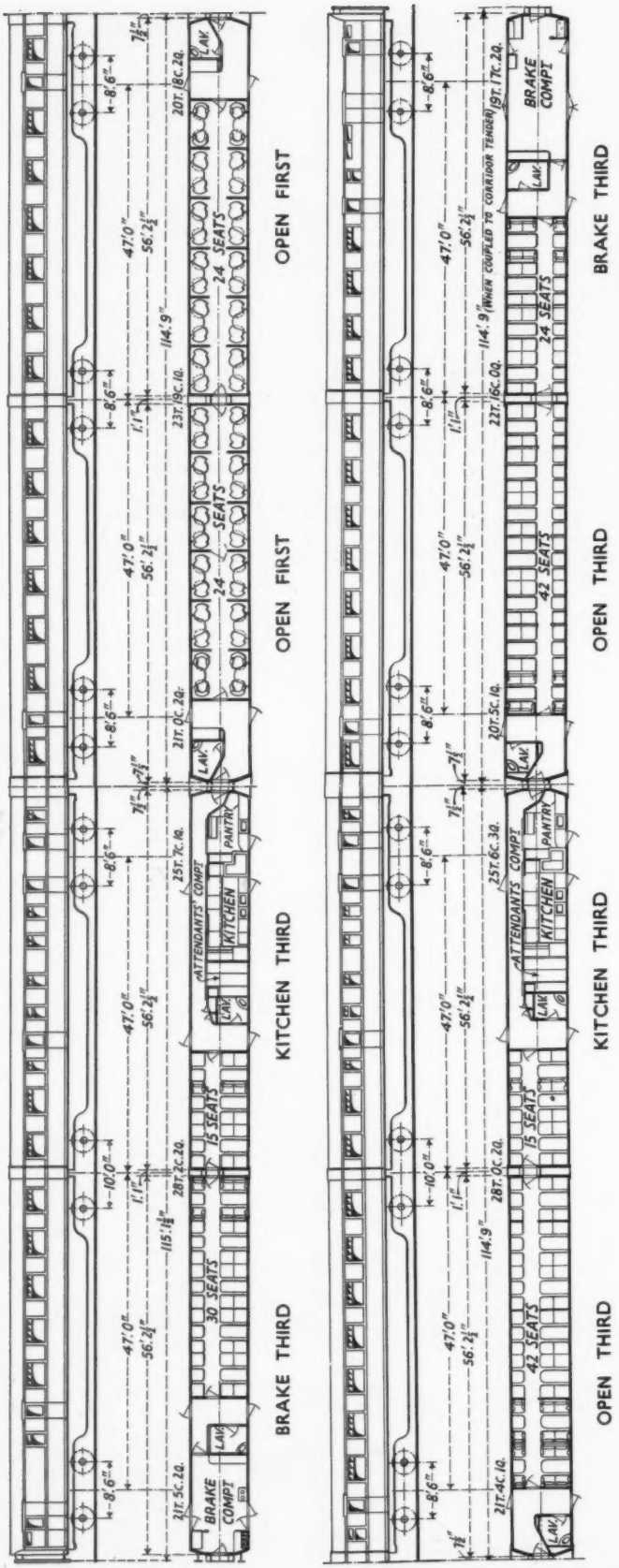
Engine and train are streamlined throughout, and india-rubber fairings cover the gaps between the carriages, which are articulated in pairs, as shown in the accompanying diagram, and give a total accommodation for 48 first class and 168 third class passengers. The total tare weight of the train is 278 tons. The main difference between the West Riding Limited train and for the Coronation expresses is that the beaver tail car incorporated in the latter is omitted in the former. The reversal of the West Riding Limited at Leeds Central station makes the use of the beaver tail impracticable. Between the pairs of articulated coaches the company's standard Pullman vestibule and buck-eye coupling are used.

Externally the train is painted the same shades of dark and light blue as the Coronation, and the streamlined locomotives are in the dark Garter blue of the lower panels of the coaches in harmony. Aluminium paint is used for the carriage roofs, and the skirtings below the underframes are black. The coach bodies are of teak framing with external steel panelling, and are mounted on welded steel underframes, carried in compound bolster bogies. A longitudinal beading of stainless steel, and stainless steel lettering in gill sans type complete the striking appearance of the train.

To ensure quiet travel the body sides, roof and floors



Photo] ***The West Riding Limited leaving Leeds*** *[The Yorkshire Post*



are insulated on the same principle as that described in our article on the Coronation express (THE RAILWAY GAZETTE, July 2, pages 30-33). The windows are of double glass with an opening upper panel. The interior finish is in Rexine decorated in original and attractive styles by Mr. Murray Adams Acton, of Acton Surgey Limited. The freshness and pleasant atmosphere of the colour schemes and the restfulness of the seating and planning are enhanced by the pressure ventilation by means of which filtered air, heated in winter to a comfortable temperature and thermostatically controlled, is supplied to the carriages at floor level. Grilles in the roof lighting fittings connecting with ducts leading to large extractor ventilators enable the air in each vehicle to be completely changed every three minutes. A great advantage of this system, too, is that the smell of cooking from the kitchens is kept out of the passenger compartments.

As in the Coronation train there are two all-electric kitchens on the West Riding Limited and every passenger can be served in his own seat. In the third class coaches cross partitions divide the saloons into three sections and passengers are seated at tables for four and two on opposite sides of the central gangway. The first class saloons are divided into sections each seating four passengers two on each side of the central gangway. The chairs are arranged to swivel and the tables between them are specially shaped to suit. The wide corridors and ample circulating spaces at the ends of the carriages which give access to the lavatories and the exterior doors, are a feature of these trains.

Contractors for Equipment

The following is a list of the firms concerned in the supply of equipment for the new trains:—

Side bearing springs: Thos. Firth & John Brown Limited; Willford & Co. Ltd.; Steel, Peech & Tozer.

Bolster springs (Timmis): Turton Brothers & Matthews Limited.

India-rubber streamlining, springs, hosepipes and vestibule diaphragms: Geo. Spencer Moulton & Co. Ltd.

Paints: Docker Brothers.

Electric cooking equipment: J. Stone & Co. Ltd.; Henry Wilson Limited.

Electric cooking batteries: Chloride Electric Storage Co. Ltd.

Coffee machines and stainless steel sinks: W. M. Still & Sons Ltd.

Pressure ventilating equipment; electric control valves for wash bowls; train lighting equipment: J. Stone & Co. Ltd.

Train lighting cells: J. Stone & Co. Ltd.; Pritchett & Gold & E.P.S. Co. Ltd.; Chloride Electric Storage Co. Ltd.; Vickers Train Lighting Co. Ltd.

Exterior steel panels: J. Lysaght Limited.

Stainless steel exterior; mouldings and fittings: Firth-Vickers Stainless Steels Limited; Industrial Units Limited.

Alpax drop light frames; steam heating and vacuum couplings: Lightalloys Limited.

Steel dovetailed sheeting: Beckett, Laycock & Watkinson Limited.

Insulation for floors, walls, heating pipes: J. W. Roberts Limited.

Aluminium fittings and decorations: The Northern Aluminium Co. Ltd.; Blunt & Wray Limited; The Chase Non-Ferrous Metal Company; Lightalloys Limited; (the whole of these fittings being finished in the Alumilite at Thames Factory, Hammersmith).

Rexine: I.C.I. (Rexine) Limited.

Upholstery materials: J. Holdsworth & Co. Ltd.; A. H. Lee & Sons Ltd.

Carpets: T. F. Firth & Sons Ltd.

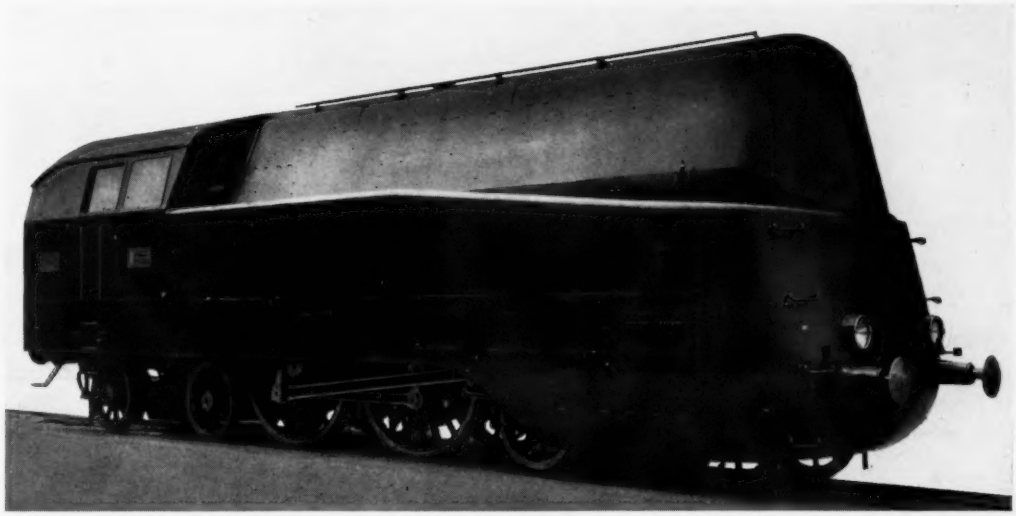
Seat spring fillings: Vi-Spring Products Limited.

Head and arm rests: Dunlop Rubber Co. Ltd.

Chairs and settees (observation car): Heal & Son Ltd.

NEW STREAMLINED 4-4-4 TANK ENGINE, HUNGARIAN STATE RAILWAYS

Designed for high-speed service on relatively light permanent way



THE locomotive illustrated was built at the Royal Hungarian State Iron Works, Budapest, from designs prepared by the Chief Mechanical Engineer of the Hungarian State Railways, the Hon. Cornelius Laner de Orsova, for the purpose of working an accelerated service of four- or five-coach trains between Budapest and some of the more distant country towns in Hungary. The permanent way on certain of the sections worked over is laid with fairly light rails, so that it was necessary to restrict the weight of the locomotive as far as possible without impairing its capacity. Of the 85·3 tons which represent the loaded weight of the engine, less than 15 tons rest on each coupled axle. The table below gives particulars of the performance of the engine on different grades with varying train loads:—

Speed (m.p.h.)	Level to 1 in 330	Grade 1 in 330 to 200	Grade 1 in 200 to 173	Grade 1 in 173 to 125
	Weight of trains (tons)			
75	167	162	157	138
68	207	197	187	167
62	241	231	217	197
56	325	310	285	236

There are two outside cylinders, driving the second pair of coupled wheels; steam distribution is by inside admission piston valves actuated by Walschaert's gear. The leading and trailing 4-wheeled bogies have a lateral play in each direction of 2¾ in., controlled by springs. All the wheels are acted upon by Knorr air brakes, with a brake cylinder pressure for a speed of 44 m.p.h. of 97 lb. per sq. in., and 34 lb. per sq. in. for lower speeds, automatically adjusted by a centrifugal regulator. At speeds over 44 m.p.h., 50 per cent. of the weight on the leading bogie is braked, 180 per cent. of the weight on the coupled wheels, and 120 per cent. of the weight on the rear bogie wheels. At 75 m.p.h., the indicated capacity of the locomotive is 740 h.p., and this can be increased temporarily to 900 h.p. It is calculated that about 10 per cent. of this output is due to the fact that the engine is streamlined. Under test the engine ran quite smoothly at speeds of 95 to 100 m.p.h., and it has also proved its ability to maintain a speed of 75 m.p.h. under regular service conditions.

Since May 22 last, the two engines of this type have been working on the easily graded Budapest—Miskolc line, a distance of 115 miles, where the fastest trains they haul are allowed 2 hr. 31 min., including three stops absorbing 12 min. of the total time. The fastest run from Miskolc to Füzesabony, 35·4 miles, is accomplished in the up direction in 39 min. (54½ m.p.h.); and the next section, from Füzesabony to Vamosgyörk, 23 miles, in 27 minutes (51 m.p.h.).

The locomotive has the following main dimensions:—

Cylinders, dia.	17 in.
Piston stroke	25½ in.
Wheels, coupled, dia.	6 ft. 6¾ in.
,, bogie, dia.	3 ft. 6 in.
Boiler heating surfaces, tubes:—	
Large and small	1,160 sq. ft.
Firebox	133 ,,
Total (evaporative)	1,293 ,,
Superheater	379 ,,
Combined heating surfaces	1,672 ,,
Grate area	30 sq. ft.
Steam pressure	270 lb. per sq. in.
Weight of engine in working order	85·3 tons.
Adhesion weight	29·2 ,,
Tractive effort	14,300 lb.

The engine is equipped with a water purifier, tilting grate, steam heating fittings, pressure adjuster for running light, mechanical lubricator, air-operated sanding gear, speed recorder, and a turbo-generator for electric lighting. The water capacity of the tanks is 2,200 gallons, and the coal bunker holds 4½ tons of fuel.

PORTABLE SLEEPER-ADZING MACHINE, BURMA RAILWAYS

Designed and built by the railway staff for about £450

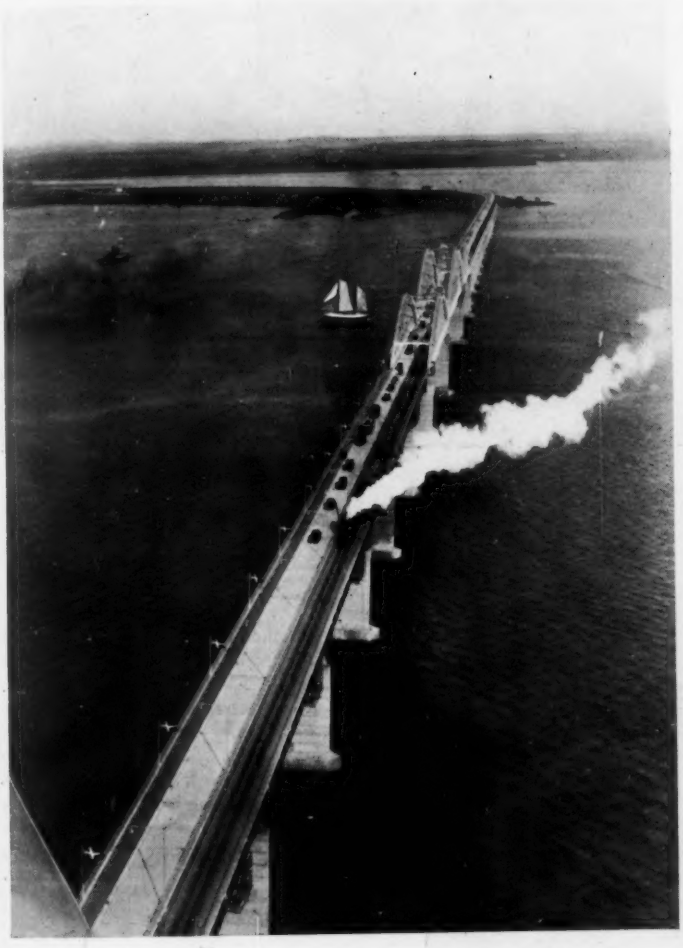
IN our issue of August 27 we described the methods adopted on the Burma Railways for the reconditioning by welding of crossings and switches, methods that have proved both economical and satisfactory. The Engineering Department of those railways is now using a portable sleeper-adzing plant, which is functioning with equally satisfactory results.

In the course of investigation into various methods of improving the permanent way, the question of adzing sleepers was considered. On these railways the flat-footed rails are spiked directly to hardwood sleepers, adzed at the rail seats to an angle of 1 in 20 by hand, and it was thought that the slight variation in the actual angle, inevitable with hand adzing, caused rail distortion and consequent rough running. An adzing machine was, therefore, designed and manufactured entirely by the railway staff, and is now in regular use. The machine is driven by a 12-h.p. Lister engine through a car-type dry plate clutch and a reducing train of four sets of crown wheels and pinions, which reduces the engine speed of 1,000 r.p.m. to 1½ r.p.m. at the last crown wheel, driving the conveyor chain at 6 ft. per min. The cutter blocks are mounted on a shaft situated beneath the table and driven at 2,000 r.p.m. from a pulley mounted on the first pinion shaft of the gear train. Each block carries a pair of blades ground to give the correct 1 in 20 cut, a pair of scriber blades giving the clean saw cut at the inner face of the adzed seatings. As is shown in the illustration, the whole machine is mounted on a truck to facilitate its transport from depot to depot, and a sloping conveyor belt, driven from the main conveyor shaft, lifts the sleepers from ground level to the adzing table, whence they slide down rails on the opposite side of the truck and are carried away. The machine was made at a cost of just under Rs. 6,000 (£450), which includes the cost of the engine, and is able to turn out adzed sleepers at 6 a min. at considerably less cost than that of hand adzing.

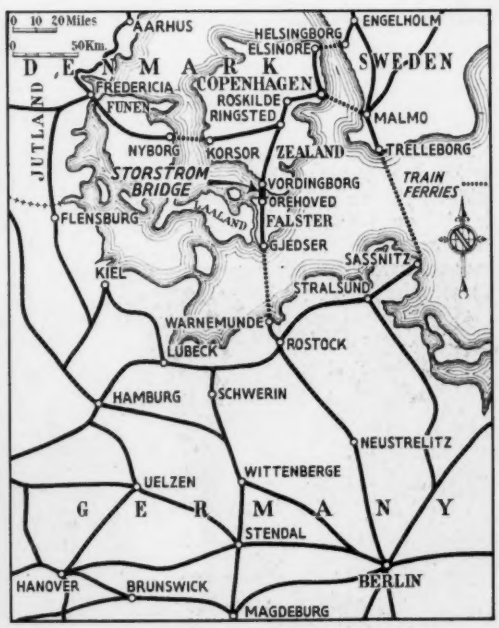
Native staff working the portable sleeper-adzing machine

New station at Wellington, New Zealand, floodlit and decorated for the Coronation (*See news article on page* 572)

Above : A train on the curved approach spans at the north end. Note the 12 ft.-deep plate girders and the slender cast-steel bearers on the hollow concrete piers



Procession of cars running alongside the inaugural train which conveyed the King of Denmark and a distinguished company after the opening ceremony on September 26

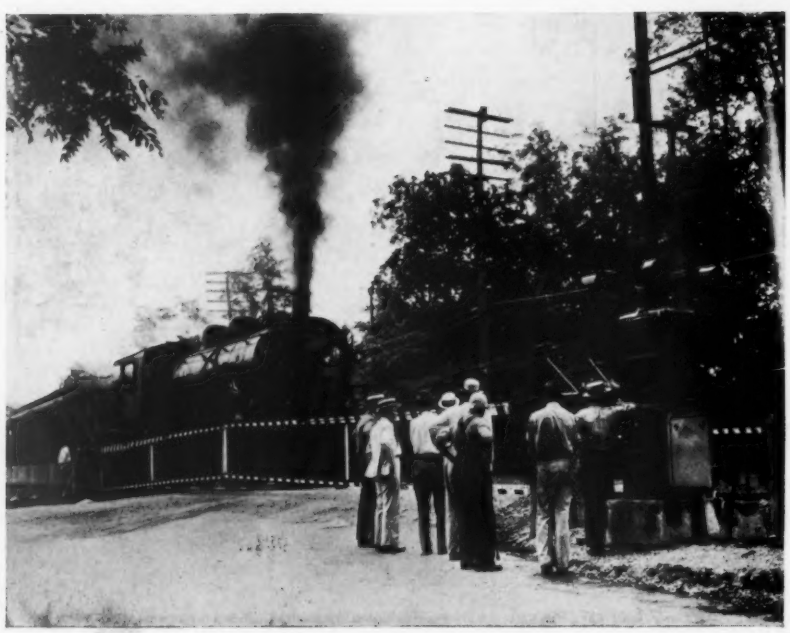


Key map showing position of the new bridge, the longest in Europe, which, by eliminating a train ferry, saves 50 min. on the through journey between Copenhagen and Berlin. The bridge, to which reference is made in an editorial note on page 541, consists of 50 spans with a total length of over two miles

THE STORSTRØM BRIDGE, DENMARK

Left: The humble buffer-stop is not generally considered as offering much scope to the architect or the landscape gardener. Yet the illustration alongside shows the attractive treatment given a pair of buffer-stops at the Stockholm East station, on the narrow gauge Stockholm-Roslagen Railway. Each stop has been cleverly combined with an illuminated train indicator on the top of a pillar, while the earthen banking on the side away from the tracks has been bedded out with scarlet begonias, cherry pie, and other homely yet colourful favourites

Right: On the streamlined trains of the Boston & Maine Railroad in the United States as well as on the de luxe coaches of the line's crack through trains, a speedometer is mounted in the rear coach so that it may be readily observed, as shown in the view on the right. There is a clock in the dial of the speedometer



Left: Automatic crossing gates installed by the Louisville & Nashville Railroad at Anchorage, Kentucky, near Louisville. Operated by electric-hydraulic apparatus, they automatically lower about 15 sec. before the passage of the train. A feature is the pair of lower safety arms which let down to within a foot of the ground. A vehicle trapped on the track can escape, as slight pressure will cause the arms to pivot outwards—but not inwards.

(*See editorial note on page* 542)

RAILWAY NEWS SECTION

PERSONAL

Overseas Railway Officers on Leave

Among the officers of overseas railways on leave or visiting this country are:—

Mr. S. J. Hungerford, Chairman and President, Canadian National Railways.

Sir Henry Chapman, General Manager, Rhodesia Railways.

Mr. C. Crofton Atkins, Traffic Manager, Central of Peru Railway.

Mr. A. E. Heskett, General Manager (Chilian Section), Antofagasta (Chili) and Bolivia Railway.

Mr. J. W. H. Rea, Chief Mechanical Engineer, Buenos Ayres Great Southern and Western Railways.

Mr. W. Coltman, Chief Mechanical Engineer, Assam Bengal Railway.

From *The London Gazette*: The King has by Letters Patent under the Great Seal of the Realm conferred the honour of knighthood upon Henry Chapman, Esq., C.B.E., Resident Director and General Manager of the Rhodesian Railway Companies. As was announced in our issue of April 2, Sir Henry Chapman (who received his knighthood in the Coronation honours this year) will retire in April, 1938.

The Secretary of State for the Colonies has recently approved the following appointment:—

Mr. N. Robson, Telegraph Inspector, to be Telegraph Engineer, Railway Department, Sierra Leone.

Mr. Robert M. Adeane, Director Buenos Ayres & Pacific Railway, arrived in Buenos Aires by the Royal Mail steamer *Arlanza* on August 14, on a business visit.

Mr. Robert Montgomery, Chief Accountant, Buenos Ayres Great Southern Railway, returned to Buenos Aires on August 24, from leave of absence in Europe.

Two new members—Mr. Peter McCarthy and Mr. William J. Grey—were on September 19 co-opted to the Dublin Port and Docks Board. Mr. McCarthy, Traders' Representative on the board, is Managing Director of O'Dea & Co. Ltd.; Mr. Grey, who will represent shipping interests, is General Manager and Secretary of the Alliance and Dublin Consumers' Gas Company.

Lt.-Col. F. R. Collins, D.S.O., V.D., Officier Légion d'honneur, M.Inst.C.E., M.Inst.Loco.E., sometime Chief Mechanical Engineer, South African Railways, and President of the Institution of Locomotive Engineers for the 1937-38 session, delivered his presidential address on Wednesday. He was

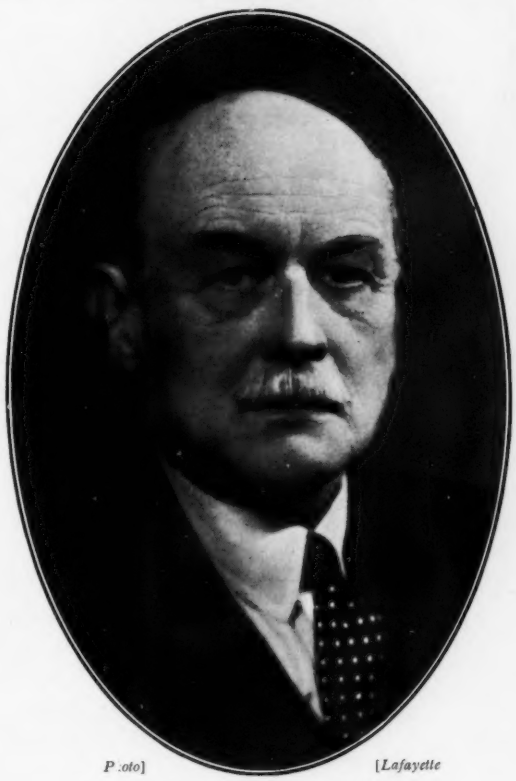


Photo [*Lafayette*

Lt.-Col. F. R. Collins, D.S.O., V.D.

President, Institution of Locomotive Engineers, 1937–38

born in 1873, was educated at Almondbury Grammar School and Huddersfield Technical School. In 1891 he became a premium apprentice at Crewe works (L.N.W.R.) and was subsequently a pupil of Mr. F. W. Webb. After experience in the drawing office he was appointed Locomotive Foreman at Ordsall Lane (Manchester) in 1896, and was later transferred first to Aston and then to Camden shed in a similar capacity. Colonel Collins saw service in the South African war (1901-2) in the Cheshire Regiment, and attached to the Royal Engineers and later to the Imperial Military Railways. Thereafter he was appointed Assistant Locomotive Superintendent Bloemfontein, Central South African Railways, and in 1903 was promoted to be District Locomotive Superintendent there, becoming Works Manager at Pretoria in the following year. He was promoted to be Superintendent, Mechanical and Motive Power, South African Railways, in 1908. During the Great War he was Lt.-Col. commanding the South African Engineer Corps in South-West Africa (1914-15), and was mentioned in dispatches. In 1916 he commanded the South African Railway Troops in France, and was later appointed Assistant Director of Light Railways, 5th Army, was again mentioned in dispatches and awarded the D.S.O.; he was also made Officer Légion d'honneur. After the war he returned to South Africa and thence visited Canada and the U.S.A., before coming to London in 1920, as Advisory Engineer to the High Commissioner for the Union. It was in 1922 that Colonel Collins became Chief Mechanical Engineer of the S.A.R., the post from which he retired in 1929. He was elected M.Inst.C.E. in 1917, and M.Inst.Loco.E. in 1920.

Mr. N. B. Hewitt, Manager of the South African Railways, Harbours, and Airways Publicity and Travel Department, proceeded on four months' leave of absence on September 29, prior to his retirement. On January 29, 1938, when Mr. Hewitt will reach his actual date of retirement, he will have completed a period of 41 years and 9 months service with the Cape Government and South African Railways. Born at Cape Town in 1878, Mr. Hewitt joined the service of the Cape Government Railways in 1896 at Port Elizabeth under the late Col. Creswell Clark, and after a short period on the traffic side, was appointed to the Engineer's Department at Cape Town and later transferred to Mafeking, Bulawayo, and again to Mafeking. During his second stay at "the fighting town," he was associated with the construction of the branch line from Mafeking to the Transvaal Border at Buurmans Drift which was initially built at the cost of the Mafeking Municipality, and the survey from the Border to Ottoshoop at the time of the agitation for the severance of Bechuanaland from the control of the Cape Colony. In 1905 Mr. Hewitt was sent to the Avontuur narrow-gauge line for completion of construction and the opening of the branch for traffic. With the establishment of Union Mr. Hewitt was appointed Chief Clerk to the Divisional Superintendent (Transportation Department) at Kimberley, and there-

after became Assistant Superintendent (Operating and Commercial) at Windhoek, later relieving in a similar capacity at Cape Town and Port Elizabeth. Transferred as Assistant Superintendent (Operating) at Durban in 1924, he subsequently also acted as Superintendent (Commercial) at that centre, and in 1925 was appointed to East London. Shortly after the establishment in 1927 of the Tourist and Travel Section, Mr. Hewitt was appointed Manager of that branch, with headquarters at Johannesburg, and whilst holding that office, on several occasions acted as Parliamentary Assistant to the General Manager. On the retirement of the late Mr. A. H. Tatlow in 1930, the Tourist Branch and Publicity Department were amalgamated and Mr. Hewitt was appointed to the control of the new organisation as Manager of the Publicity and Travel Department. Thus for the past 10 years, Mr. Hewitt has been actively associated with the tourist and publicity movement, and although during that period he has been afforded opportunities for re-transfer to the Transportation Department, he elected to continue his activities in the direction of the furtherance of the tourist industry in its application to South Africa, and the progressive development of both local and overseas publicity propaganda. During his long period of service Mr. Hewitt has occupied responsible posts on seven of the nine systems comprising the South African Railways and Harbours Administration. He has on many occasions had a seat on the Sick Fund Board, and is a member of the Headquarters Technical Library Committee and Railway Charitable Fund Committee, as well as being Managing Editor of the *S.A. Railways and Harbours Magazine*. In the course of an eventful career, Mr. Hewitt saw active service in the Bechuanaland Rebellion in 1897, and in the South African War was attached to Baden Powell's staff during the siege of Mafeking. In the late war he was on military service in the Union and in South West Africa. In addition to military decorations, Mr. Hewitt was awarded both the Jubilee and Coronation medals. At the close of the recent annual conference of the S.A. National Publicity Association held at Salisbury, Mr. Hewitt was the recipient of a silver salver and a handsomely-fitted travelling case presented to him by the various publicity bodies and delegates, on the occasion of his retirement.

Mr. D. M. Robbertze, who has been appointed Manager of the South African Railways, Harbours, and Airways Publicity and Travel Department, in succession to Mr. N. B. Hewitt, was born and educated in the Orange Free State, and joined the railway service at Bloemfontein at the beginning of 1913. He served in that province in various capacities, both at

Mr. N. B. Hewitt

Who is retiring from the position of Manager, South African Railways, Harbours, and Airways Publicity and Travel Department

Mr. D. M. Robbertze

Appointed Manager, South African Railways, Harbours, and Airways Publicity and Travel Department

The late Mr. Bertram F. Tee

Commercial and Operating Assistant to the Superintendent of Road Transport, Great Western Railway, 1934-1937

Sir Josiah Stamp, laying the foundation stone of the new L.M.S.R. School of Transport at Derby, on Wednesday of last week, as reported in last week's issue

stations and in the system office, until 1925, when, after six months' relief duty in the General Manager's Parliamentary Section, Johannesburg, he was transferred to Cape Town, where he remained until 1927. While stationed at the last-mentioned centre, he was selected to act as secretary to the special committee appointed to investigate the rolling stock position throughout the Union. Mr. Robbertze proceeded to Johannesburg in March, 1927, on special duty in the Road Motor Section, Headquarters, and with the establishment of the tourist section he was transferred to that branch at Johannesburg. Eighteen months later he was selected for appointment to the Administration's Publicity and Tourist Bureau in the High Commissioner's Office, London. He returned to the Union in May, 1933, to assume duty in the System Manager's office at Port Elizabeth, and shortly afterwards was transferred to the office of the Minister and of the Railways and Harbour Board, where he remained until April of this year, rising to the position of Chief Clerk. Mr. Robbertze returned to the Publicity and Travel Department, at Headquarters, as Assistant Manager, some six months ago, and in addition to now taking over the reins of managership, he becomes Managing Editor of the *S.A. Railways and Harbours Magazine*, which position Mr. Hewitt also relinquishes on his retirement under the age limit rule.

It is with regret that we record the death, on September 15, of Mr. Bertram Frank Tee, the Commercial and Operating Assistant to the Superintendent of Road Transport, G.W.R. Although he had suffered in health in later years, his sudden death was a shock to all who knew him, and many will learn with surprise that he was 61 years old, for he looked at least 10 years younger. Mr. Tee entered the service of the Great Western Railway in 1890 and had a varied railway experience. After several years of general station experience in the Reading district, he joined the office of the Superintendent of the Line at Paddington, where he was in turn engaged on timebill, rates and fares, and staff work. On the general classification of staff in 1919 he was made responsible for the whole of the work so far as the Superintendent of the Line's Department was concerned. Mr. Tee joined the Road Transport Department on its formation in 1922, and became the first Chief Clerk, and subsequently Assistant to the Superintendent. His power of assimilation of detail and cool judgment made him a valued member of the various committees with which he was connected, and he played a prominent part in inter-railway discussions regarding road transport problems. In August, 1934, he was appointed Commercial and Operating Assistant to the Superintendent of Road Transport, which office he held to the time of his death.

The term of office of Herr P. Knutzen, General Manager of the Danish State Railways, has been extended to the end of October, 1943.

The Right Hon. Lord Cadman, G.C.M.G., D.Sc., a Director of the Great Western Railway, and Chairman of the Anglo-Iranian Oil Company, will preside at the seventy-sixth anniversary festival of the United Kingdom Railway Officers' & Servants' Association to be held at the Trocadero Restaurant, London, on Wednesday, October 20.

We regret to announce the death of Mr. Bertram Walter Burrow, Assistant Sales Manager of Callender's Cable & Construction Co. Ltd., on September 24. Mr. Burrow had been in the service of the company for nearly 40 years. Entering as a boy, he had by his ability and industry reached the responsible position he occupied. He was highly esteemed by his firm and by all with whom he came in contact, and his death is deeply deplored.

Mr. Robert Hardie, Traffic Manager of the 15-in. gauge Romney, Hythe & Dymchurch Railway, whose forthcoming retirement was announced in our issue of April 2 last, relinquished his duties last week at the end of the railway company's summer season. On Monday night the entire staff of the railway assembled at a dinner given in his honour, and all the stations on the line were closed. Mr. Hardie was presented with a travelling clock.

At the annual general meeting of the Paulista Railway, the following officers were elected for the three years 1938 to 1940 :—

President : Dr. Antonio de Padua Salles.
Vice-President : Dr. José de Paulo Leite de Barros.
General Secretary : Dr. Heitor Freire de Carvalho.
General Inspector : Dr. Jayme Pinheiro de Ulhoa Cintra.
Directors : Dr. Luiz Tavares Alves Pereira, Snr. Antonio Prado (Junr.), and Snr. Clovis Soares de Camargos.

Presentation to Mr. W. R. Jones

A complimentary luncheon to Mr. W. R. Jones, whose retirement from the position of Divisional Signal & Telegraph Engineer, Hunt's Bank, Manchester, L.M.S.R., was recorded in our issue of June 18, was held at the Euston Hotel on September 22 in the presence of some 40 representatives of the Signal and Telegraph Department. Mr. A. F. Bound, Chief Signal and Telegraph Engineer, presided, and, with other speakers on behalf of the L.M.S.R. paid tribute to Mr. Jones's long and honourable railway service. Mr. W. S. Roberts, of the Railway Signal Company, also recalled his long and happy association with Mr. Jones. Messrs. A. Oldham, S. W. Spendlove, and H. Jones also spoke of the privilege of long association with Mr. W. R. Jones, the ready assistance they had always received from him and his popularity in the department. Mr. Bound then presented Mr. Jones with a suitably inscribed grandmother clock, and a photographic super-speed condenser enlarger, on behalf of his departmental colleagues and with their best wishes. Mr. Jones returned thanks in a suitable reply.

It is with regret that we learn of the death on Friday, September 24, at the age of 81, of Mr. Mortimer Constantine Tait, who was from 1915 to 1921 Chief Solicitor to the former London & North Western Railway Company. Mr. Tait was articled in 1874 to Mr. Brodhurst Hill, who was then Assistant Solicitor to the company, in charge of the Conveyancing Department, Mr. R. F. Roberts being Chief Solicitor. On the completion of his articles, Mr. Tait was admitted on the company's staff as Solicitor Assistant in the Conveyancing Department. When Mr. Brodhurst Hill retired in 1892 the Solicitor's Department was reorganised on different lines. Instead of the Assistant Solicitor being concerned mainly with conveyancing, he was made directly subordinate in all branches to the Chief Solicitor, and ranking immediately below the Assistant Solicitor there was appointed a separate chief clerk to each of the Common Law, Conveyancing, and Parliamentary Departments. Mr. C. de J. Andrewes was appointed Assistant Solicitor in 1892 and retained that position until January, 1903, when he succeeded the late Mr. C. H. Mason as Chief Solicitor. Mr. Tait succeeded Mr. Andrewes in 1903 as Assistant Solicitor, and on Mr. Andrewes' retirement in July, 1915, succeeded him as Chief Solicitor, retiring in February, 1921.

The funeral took place on Tuesday at St. Luke's Church, Kidderpore Avenue, Platt's Lane, Hampstead. In the absence abroad of the Chief Legal Adviser (Mr. H. L. Thornhill) and of the Chief Solicitor (Mr. A. Eddy), of the L.M.S.R., they were represented at the funeral by Mr. G. Lister Smythe and Mr. E. Henley.

Indian Railway Staff Changes

Mr. P. W. Wilton Davies has been appointed to officiate as Deputy Chief Engineer, N.W.R., as from July 7.

Mr. H. J. Allinson has been permanently promoted as Deputy Chief Mechanical Engineer, Electrical, E.B.R.

Mr. F. R. Morgan, Chief Engineer, N.W.R., has been permitted to retire from Government service, as from August 7.

Mr. T. D. Macintosh, Deputy Locomotive and Carriage Superintendent, metre gauge, B.B. & C.I.R., has been granted seven months' leave, as from August 11.

Mr. D. M. S. Robertson, Chief Operating Superintendent, E.I.R., has been granted 19 months' leave preparatory to retirement, as from September 12.

Institution of Locomotive Engineers: Presidential Address

At the 1937-8 session opening general meeting of the Institution of Locomotive Engineers in London yesterday Mr. W. A. Stanier, Chief Mechanical Engineer, L.M.S.R. and President of the Institution for the 1936-7 session, formally inducted Lt.-Col. F. R. Collins, D.S.O., into the chair as the new President. Mr. Stanier took the opportunity of thanking the secretary and committee for their assistance during his term of office. Referring to his recent visit to India he mentioned it was also the first occasion on which the President of the Institution had had an opportunity of attending a general meeting of the Indian Centre, and he conveyed to them greetings from that centre. He wished Lt.-Col. Collins as pleasant a year of office as he had himself experienced. Mr. J. W. Beaumont proposed a vote of thanks to the retiring President and Mr. W. J. Jerram seconded.

Lt.-Col. Collins then read his Presidential Address, the main portion of which was a discussion with many examples illustrated by lantern slides of the gauge, overall dimensions, weight and tare-load ratios of rolling stock—other than locomotives—used on various railways throughout the world. The locomotive engineers' task, the speaker emphasised, was to move passengers and freight quickly, safely and at the lowest possible cost. Within the last forty or fifty years steam locomotives had developed to machines giving up to 50,000 lb. tractive effort, and in articulated types up to even 140,000 lb. They had seen in that time the advent of electric traction, and today there were multiple units of 1,200 to 2,000 h.p. each, while there was also the internal combustion engine. It was probable that most railways of any size had sections to which one or other of these systems of motive power was best suited.

The rapidly widening use of the internal combustion engines for road and air travel was taking traffic once the sole concern of railways. Some of the business lost had gone for good, but much could and should be regained. One way of easing the problem was unity of control for rail, road, air and water transport. All railways shared in common the object of hauling passenger and freight traffic at the least possible cost and best possible speed. With regard to speed on rail, passenger services at maximum rates of over 100 m.p.h. had been attained, and the institution could be proud of its members who were making history in that direction. Speeds of 70 and 120 m.p.h. respectively, are possible on the 3 ft. 6 in. and 4 ft. 8½ in. gauges with standard locomotives and rolling stock. Whether the broad gauge could go further remained to be seen. Axle loads of 30 tons were in use and goods trains of 14,000 tons were being moved.

Lt.-Col. Collins then examined ways in which costs of haulage could be reduced. One method, he suggested, was by reducing tare loads. Incidentally the cost of carriage of fuel and water in locomotive tenders, as against the cost of electrification, he thought, was an interesting study.

Comparing the power required and loads moved by steam trains, private motorcars and motor coaches, Lt.-Col. Collins estimated the power per passenger, for similar speeds in the case of the first two, and at lower speeds in the case of the last named, for each mode of transport respectively, at 2 h.p. (1,400 lb. tare per passenger), 2·5 h.p. (400 lb. tare) and 1·5 to 3 h.p. (480 lb. tare). If legend was correct, the speaker continued, a galloping Roman chariot on mail service averaging 20 m.p.h. in daylight and 9 m.p.h. over twenty-four hours, could deliver a letter under favourable conditions in London a week or so after leaving Rome and, assuming the chariot was occupied only by the driver, required 2 h.p. per person to effect this.

Examples of Varying Tare-Load Ratios

For the next section of his address, Lt.-Col. Collins used slides showing a wide variety of railway wagons and coaches and quoted their overall dimensions and tare-load ratios. In this detailed examination the more favourable ratios afforded by narrow gauge were made abundantly clear. The relation of loading gauge to running gauge was touched upon with especial reference to the findings of the Royal Commission published in 1921 on uniform railway gauges for Australia, which findings included the suggestion that those who contended they would increase the track gauge should give their attention rather to the structure gauge. Lt.-Col. Collins stated on this point that a structure gauge could be adopted very much wider than 2·9 to 1 and very much higher than 3 to 1 compared with the running gauge. Single lines working with modern methods of signalling and control could, he considered, carry a surprising amount of traffic, but whether the railway position in the world of transport could be so improved that it could successfully compete with its rivals by increasing loading gauge, decreasing dead load and increasing pay load was worth thinking over.

Some of the examples shown by the slides, which illustrated also some instances of specially designed lightweight stock, included 2 ft. gauge wagons carrying 3·8 times the tare load, metre gauge wagons carrying 2 to 2·4 and 3 ft. 6 in. and 4 ft. 8½ in. gauge wagons carrying 2·5 times. In the case of passenger coaches, Lt.-Col. Collins compared more particularly the weight per foot run and showed examples giving features of 8·8 cwt. for metre gauge, 7·9 cwt. for 3 ft. 6 in. gauge, 9·6 cwt. for 3 ft. 6 in. gauge multiple-unit electric motor coaches, 10 cwt. for 4 ft. 8½ in. gauge steam stock and 17 cwt. in one example for 5 ft. 3 in. gauge electric motor coaches. A Cordoba Central Railway 68 ft. metre-gauge coach, in which the width over roof sheets was just on three times the gauge, had a carrying capacity equal to, and a width only 8 in. less than, some of the broad gauge coaches, while its tare load was less by nearly 6 tons.

Concluding his address Lt.-Col. Collins acknowledged his indebtedness for the loan of the slides, particularly to Mr. A. J. Boyd who had kindly furnished over half the illustrations shown. Lt.-Col. E. Kitson Clark proposed a vote of thanks to the new President and Mr. J. G. B. Sams seconded.

Forthcoming Events

Oct. 4 (*Mon.*).—Stephenson Locomotive Society (London), at King's Cross Station, L.N.E.R., 6.30 p.m. "The Control of Train Speeds on the G.W.R.," by Mr. C. Roberts.

Yorkshire Transport Society, at County Restaurant, Bridge Street, Bradford, 7.30 p.m. "The Story of the London Bus."

Oct. 5 (*Tues.*).—Great Eastern Mechanics' Institution, Stratford, 8 p.m. "Canyons of the Rockies," by Mr. R. Tanner.

L.N.E.R. (York) Lecture and Debating Society, at Railway Inst., Queen Street, 6.45 p.m. "A Survey of Modern British Signalling Installations," by Mr. C. Carslake.

Oct. 6 (*Wed.*).—Institution of Railway Signal Engineers, at Inst. of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. "Central Box Amalgamation Schemes," by Mr. A. Moss.

Oct. 7 (*Thurs.*).—Railway Club, at Royal Scottish Corporation Hall, Fetter Lane, London, E.C.4, 7.30 p.m. "Railway Developments," by Mr. W. A. Willox.

St. Pancras House Improvement Society Limited, at York Rise, Highgate Road, London, N.W.5, 3.15 p.m. Laying of Foundation Stone by Sir Josiah Stamp, G.C.B., on behalf of the L.M.S.R.

Oct. 9 (*Sat.*).—Stephenson Locomotive Society (Midlands and Northern), at 4, Bury Old Road, Manchester. 6.30 p.m. Annual Meeting.

Oct. 11 (*Mon.*).—Institute of Transport (London), at Inst. of Electrical Engineers, Savoy Place, W.C.2, 5.30 p.m. Presidential Address by Sir Alexander Gibb, G.B.E.

Oct. 12 (*Tues.*).—Permanent Way Institution (Brighton), at Railway Inst., New England Street, 7.15 p.m. "The Evolution of Permanent Way," by Mr. Charles E. Lee.

Oct. 13 (*Wed.*).—Permanent Way Institution (London), at Underground Railway Dining Club, Pelham Street, S.W.7, 7 p.m. "Recent and Probable Developments in Permanent Way," by Mr. K. Brinsmead.

Oct. 13–15.—Institution of Mechanical Engineers, Storey's Gate, London, S.W.1. General Discussion on Lubrication and Lubricants.

Oct. 15 (*Fri.*).—Omnibus Society, at Inst. of Marine Engineers, The Minories, London, E.C.3, 7 p.m. Debate: "The Ideal Transport Undertaking is of Moderate Size." Affirmative: Mr. I. Watkin. Negative: Mr. N. Burchill.

Oct. 16 (*Sat.*).—Permanent Way Institution (Manchester–Liverpool), at Temperance Inst., London Street, Southport, 3 p.m. "Creosoting of Timbers," by Mr. R. Chamberlain.

Stephenson Locomotive Society (Scottish), at Mathieson's Restaurant, Falkirk, 3 p.m. Annual Meeting.

MINISTRY OF TRANSPORT ACCIDENT REPORT

Sleaford North Junction, L.N.E.R., February 15, 1937

At about 12.45 p.m. as the 10.25 a.m. express, York to Lowestoft, was traversing the junction it became derailed; the three leading coaches broke away, were diverted and fell over to the left, wrecking a platelayers' hut where 5 men were at dinner; three were killed, another died later, and a fifth was seriously injured. Fifteen passengers suffered minor injuries and shock. The train consisted of 10 bogie vehicles with steel underframes and timber bodies; all but the seventh had Buckeye couplers; the engine was No. 2829, 4-6-0 type. It ran forward about 69 yd. after the derailment, stopping with the bogie on the rails and coupled and tender wheels derailed. The fourth, fifth and sixth coaches were derailed all wheels; the last four kept the rails. The weather was fine with good visibility and the rail dry.

The line approaching the junction is straight from beyond the distant signal, continuing straight towards Spalding as lines for goods trains only though called the main line; the branch line curves to the right to Sleaford station, with a 20 m.p.h. speed restriction; this was 15 m.p.h. until the beginning of 1937, but the limit was raised in the periodical review of all speed restrictions. Gradient is 1 in 460 rising to the junction and 1 in 650 falling towards Sleaford. Col. A. C. Trench conducted the inquiry.

The train left Lincoln 8 min. late. Driver L. Green had been on this road since 1919, and was familiar with the train and type of engine. He said he approached the distant signal, which was "on," at 50 to 55 m.p.h., and reduced to, as he considered, about 20 m.p.h. at the home signal, then putting the brake handle in running position but not opening the regulator. He was aware of nothing amiss until the engine was through the diamond; he then heard a rattle from the tender, felt a bump, then further bumps. Putting his hand to the brake handle he saw the vacuum destroyed and knew a coupling had parted.

Guard Tindall and several others considered that speed had been reduced to about 20 m.p.h.

The evidence of Ganger Speed, confirmed by others, was to the effect that the permanent way was receiving only ordinary maintenance at the time. The men had gone to dinner, and the ganger, who went home for his, heard nothing of the accident till he came out again and saw the derailed coaches. Careful inquiries were made as to the possibility of tools having been left on the track, but all were found complete, in good order. A goods train had passed after the gang ceased work and before the express.

The Locomotive

Engine No. 2829 was built in 1931 and had run about 234,000 miles—37,000 since general repairs in March, 1936, since when there had been no unusual defects. The engine had been weighed and adjusted to diagram weights in June, 1936; the accompanying drawing indicates general dimensions, designed axle weights and actual weights after derailment. No spring was broken. In central position the bogie control springs exert a pressure of 0.32 ton; with maximum designed lateral translation of 4 in., the pressure on one side rises to 1.6 tons. Bogie axle vertical and lateral clearances showed no material discrepancy from design; all bogie wheels were true to gauge and had good tyres without marks of damage or abrasion. Leading coupled wheels were $\frac{5}{16}$ in. wide to gauge at one point, probably from bending of the cranked axle through derailment; the remainder were true to gauge. All six tyres were of good profile, but considerably marked and indented. Nothing indicated the axle boxes having been in contact with the hornblocks or hornstays. Tender wheels were true to gauge and of good profile.

The Permanent Way

Minimum curvature of the up branch line through the junction was 16 ch. The common crossing was 1 in 12, the diamond 1 in 8. Track was 95 lb. G.N. standard laid in 1914, except the switches and 1 in 12 crossing laid in 1928 and 1935 with 95-lb. B.S. material. Fastenings generally were two coach screws and two spikes, and the ballast was slag. Track through the junction was not seriously damaged, and Col. Trench found it in good condition.

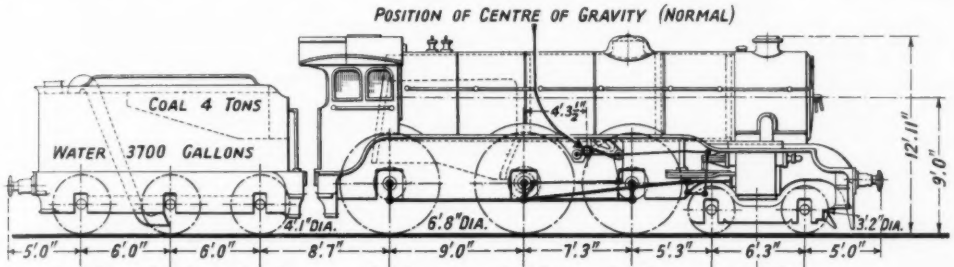
Inspecting Officer's Conclusions

All the evidence, except the general impression of the engine crew, points to some of the coupled wheels being the first derailed. The possible causes of the derailment appear to be:—

(*a*) Obstruction, probably in the check rail flangeway.
(*b*) Defective track
(*c*) Defective locomotive
(*d*) Excessive speed
} alone, or in combination.

Col. Trench considers there is nothing to point to (*a*), nor in any appreciable degree to (*b*), as causes. With regard to (*c*) the only point bearing on the case is the differences between actual and designed weights (see diagram), particularly on the leading coupled wheels. They may be due to some extent to the derailment, and not in existence previously, but it is reasonably probable that uneven weight distribution may have had some bearing on the accident. With regard to (*d*) Col. Trench feels considerable doubt of the accuracy of Driver Green's speed estimate of 20 m.p.h., and holds the evidence of other witnesses of not much value on the point. It was not their business to assess the speed, and there is, it is well known, a tendency, after running at high speed, to over-estimate any reduction by braking. Timings indicate that the train was approaching faster than the 50 or 60 m.p.h. estimated by some witnesses.

To test what Green said about travelling through the junction, Col. Trench made a trial run with the same engine,



T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.		T. C. Q.	
14·8·0	13·9·2	11·10·2	17·15·0	18·0·0	18·0·0		22·18·0	DESIGNED AXLE WEIGHTS
11·13·0	10·15·0	11·11·0	18·19·1	16·2·0	15·11·0		25·5·3	AXLE WEIGHTS AFTER DERAILMENT
5·18·0	5·3·0	5·17·0	9·9·2	8·1·0	8·4·0	6·8·3	6·4·2	L.H. WHEEL WEIGHTS AFTER DERAILMENT
5·15·0	5·12·0	5·14·0	9·9·3	8·1·0	7·7·0	5·19·2	6·13·0	R.H. " " " "

Diagram of locomotive No. 2829 concerned in Sleaford accident

then fitted with a speed recorder, and a train of identical composition, but unfortunately the driver slowed to rather below 20 m.p.h.; but even if the train could have coasted round the curve, as the driver asserted, speed would become abnormally low, lower than Green, running 8 min. late would probably have allowed it to go. The effects of the derailment, too, indicate a speed of 40 m.p.h. or over, as does the distance run by the engine after the vacuum pipe broke. Since the accident, in spite of all the publicity of the case, up trains have been timed through at 37 and 40 m.p.h. and down trains at 47 m.p.h. Such disregard of the 20 m.p.h. restriction is strongly to be deprecated, and suitable steps have been taken in the matter. Calculations show that if speed was excessive the leading edge of the flange of the leading right-hand coupled wheel would be meeting the check rail at an angle, resulting in a biting action and a natural tendency to climb. It is impossible to say whether the incorrect weights measured were wholly or partly in existence before the derailment, but they might have somewhat enhanced the risk. The sequence of events after it occurred is necessarily speculative.

Driver Green is held mainly responsible for the accident; he has 40 years' service, 20 as driver, with a good record. There can be little doubt that his speed through the junction was considerably in excess of 20 m.p.h.

Recommendations and Remarks

There must on any railway be places having very definite limits of safe speed, prescribed by the Engineer. Drivers have to acquaint themselves with these restrictions when learning the road and obey them when driving. It has been held for many years past that reliance should be placed on drivers to judge speed with sufficient accuracy in the observance of the specified restrictions; broadly speaking, this has been justified by results. Speeding up, adopted in recent years and likely to continue, has modified the situation owing to the increasing difficulty in judging correctly a moderate or low speed after an abrupt reduction from a much higher one. If normal running speeds on straight and open line are increased, it is more important to obey the restrictions imposed at special places.

Speed indicators, with or without recorders, are common on fast locomotives throughout the world, and are being fitted to some of the most recent express locomotives in Britain. Attention is drawn to Col. Mount's remarks in his report on the accident at Carlisle in 1931, and his recommendations endorsed that speed indicators on locomotives for high-speed trains merit the serious consideration of the companies, being likely to afford material assistance to drivers. That report referred also to the advantages of providing local indications of permanent speed restrictions, as a further assistance to them. It is desirable that the permanent way staff be impressed with the importance of reporting when a local speed restriction is seriously or frequently infringed. The responsibility for determining a safe speed must lie primarily with the Engineer; the responsibility for observing it lies with the driver. If the tender coupling had been of the Buckeye type the results of initial derailment would probably have been much more limited; this type is fitted to tenders with a Pullman vestibule connection, but there are understood to be practical objections to fitting it unless accompanied by such a vestibule.

STAFF AND LABOUR MATTERS

Railway Shopmen : Industrial Court Decisions

The Industrial Court has recently heard four claims affecting railway shopmen. The claimant in every case was the National Union of Railwaymen; the Southern Railway was the respondent in three instances and the L.M.S.R. in the other.

Decision No. 1,682 (August 11) deals with an application for extra payment to be made to a bodymaker employed in the Chief Mechanical Engineer's department at Selhurst (Southern Railway), whilst employed on fitting electrical heaters to electric stock. The work in the main was done within the compartments and, in the view of the railway company, called for no special payment, but the company offered to pay sixpence for eight hours of the time worked underneath the coaches and the Court decided that this payment meets the requirements of condition 11 of Schedule " F " to Decision No. 728.

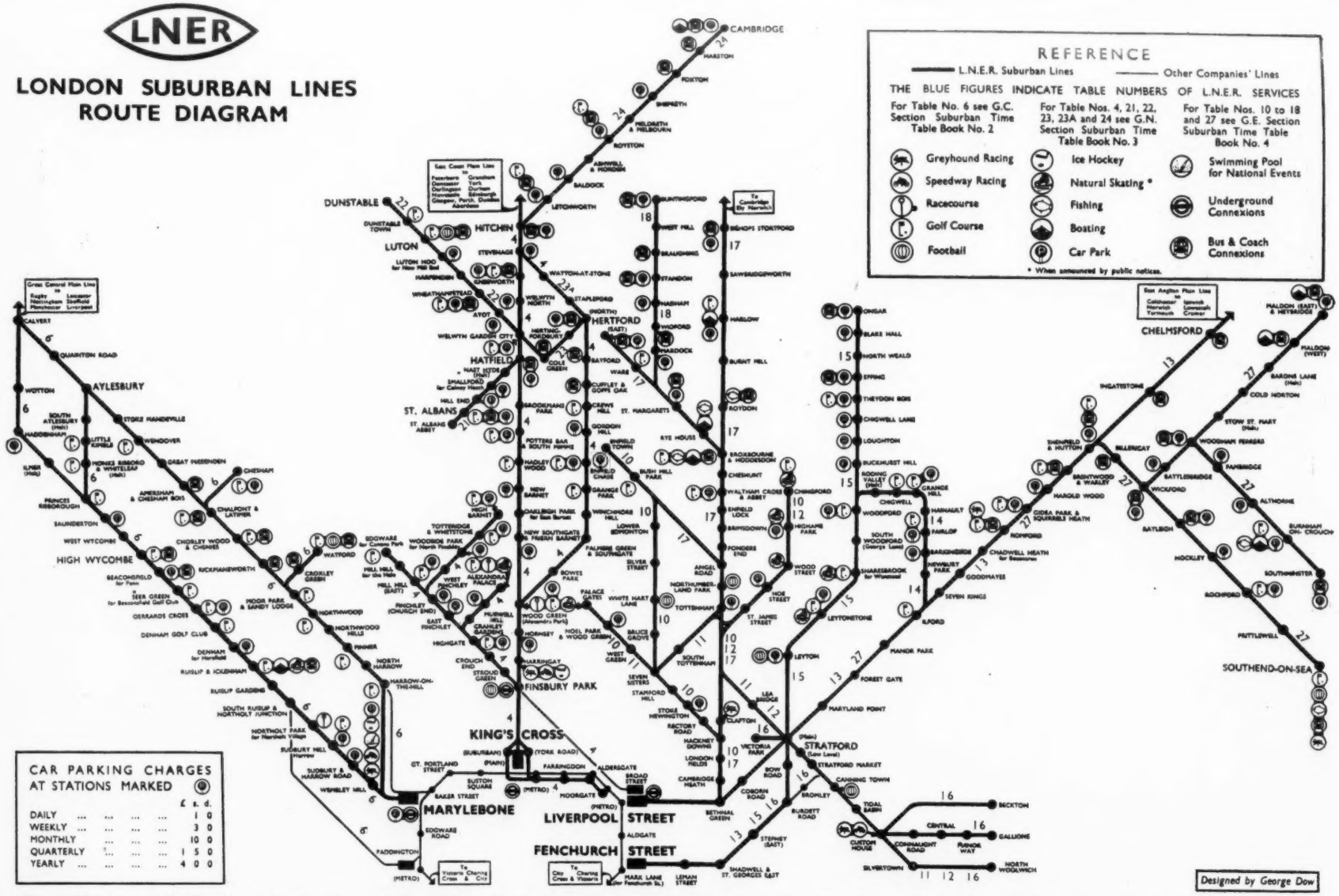
In Decision No. 1,684 (September 21) the Court finds that a labourer employed at Earlestown (L.M.S.R.) when temporarily employed on the work of cleaning out cesspools shall be paid at the rate of Labourer, grade 1, plus an allowance of one shilling a day when, for the purposes of the work, he has to descend a ladder.

Decision No. 1,685 (September 21) also deals with a claim concerning an individual, in this particular case, an acting fitter employed in the Civil Engineer's Department at New Cross Gate (Southern Railway). Between July 8 and September 15, 1935, the man was a member of a gang engaged upon work which consisted in fitting facing point locks and connections, &c. The union contended he should have been paid at the rate of fitter, grade II, but the court found against the claim.

Decision No. 1,686 (September 21) is of more general interest. A question having arisen between the National Union of Railwaymen and the Southern Railway Company in connection with the payment to be made to certain men employed in the Locomotive Department at Bricklayers' Arms in respect of the time occupied in travelling to the site of a derailment on June 21, 1936, application for a decision was made by the union to the Court, as a matter of interpretation of Condition 5 of Schedule " F " of Award No. 728, which reads as follows: " All time worked between 12.0 midnight Saturday and 12.0 midnight Sunday (exclusive of travelling time) shall be paid at double ordinary day rate, with a minimum payment of three hours at ordinary rate. Anyone who is called on duty and on presenting himself for duty is not required to commence work shall be paid a minimum of two hours at ordinary day rate."

On Saturday, June 20, 1936, a call for the breakdown gang was received at Bricklayers' Arms at approximately 11.45 p.m., and certain fitters who were on duty prepared the tool vans and crane whilst the remaining members of the gang were sent for. The men on duty had booked on at 5 p.m. on Saturday, those specially sent for booked on at 12.15 a.m. on June 21, and the breakdown train thereafter proceeded to Brighton, where the accident had occurred. The men were on duty from 12.15 a.m. to 12.30 p.m. The men were paid time and a half for the time occupied in travelling with the breakdown train and at double ordinary rate for the time they were at work, except in the case of one man who rode on the steam crane, for the purpose of preparing the fire, raising steam, &c., who was paid double time throughout. The breakdown train is formed of five vehicles, namely, steam crane, tool vans, and coach in which the men travel.

The union contended that inasmuch as the men concerned were travelling as members of the breakdown gang, and not as passengers, they should have been regarded as being on duty and entitled to double time throughout. The company on the other hand submitted that the payments were in accordance with the provisions of condition 5 of Schedule " F " to Award No. 728. The Court said that the provisions of condition 5 of Schedule " F " are to be read in conjunction with the provisions of Condition 8 of Schedule " F," which provides, *inter alia*, that " all time occupied in travelling (whilst on duty) on Sunday . . . to be paid for at ordinary day rate and a half . . . " and after a careful review of the provisions of Conditions 5 and 8, the Court was unable to accept the contention on which the union's claim is based and ruled accordingly.



Route diagram of the London suburban lines of the London & North Eastern Railway, designed by Mr. George Dow, showing the various points of interest and the Underground and bus and coach connections on all three, Great Central, Great Northern, and Great Eastern, sections. Mr. Dow has previously designed separate diagrams for the suburban services of the L.N.E.R.; that for the Great Central section was reproduced in our issue of April 29, 1932. These diagrams have been appropriately referred to as "Dowagrams"

THE MONTH'S RAILWAY LAW

Electricity Supply

The Wirral Railway Case (1937) 3 All.E.R.691.

We have in a previous number referred to Mr. Justice Simonds' judgment in *Attorney General* v. *Liverpool Corporation and London Midland & Scottish Railway Company*. It was really a dispute between the Liverpool Corporation and other suppliers of electricity in the district as to the right to supply the company with electricity for the Wirral Railway. The matter is governed by the Electricity (Supply) Act, 1926, and the right of supply is regulated by Section 47 of that Act.

The Wirral Railway was outside the Corporation's area of supply, and the main point of the case from the railway point of view was whether the "undertaking" of the London Midland & Scottish Railway Company was to be considered as a whole since the amalgamation of 1921, or whether it was to be split up into its component parts, in which case the corporation would have no right to supply the railway company for the purpose of the Wirral Railway. The Court of Appeal in affirming Mr. Justice Simonds' decision held that the railway undertaking must be looked at as a whole, as undoubtedly Parliament intended in passing the Electricity (Supply) Act, 1926, and that the London Midland & Scottish Railway Company was competent to take a supply for haulage and traction under the Act from the Liverpool Corporation.

Minerals Under Railway Land

Land sold to a railway company for the purpose of its undertaking does not ordinarily include the minerals underneath, and the Railways Clauses Consolidation Act, 1845, S.77, makes express provision reserving mineral rights to the vendors "unless expressly purchased." The difficulty is to decide what are minerals. In *Great Western Railway* v. *Carpalla United China Clay Co. Ltd.*, 1910, A.C.83, it was held that china clay lying adjacent to lands in Cornwall which had been purchased by the railway company was a "mineral" within Section 77, and therefore was preserved to the vendors for working. The test was laid down by Lord Macnaghten in *Farie's Case* (13 App. Cas. 657), where he says that it has a wider meaning than mines and probably includes "every inorganic substance forming part of the crust of the earth other than the layer of soil which sustains vegetable life." Lord Justice Fletcher Moulton in the *China Clay Case* defines it as "any substance that can be got from within the surface of the earth which possesses a value in use, apart from its mere possession of the bulk and weight which make it occupy so much of the earth's crust." An interesting echo of the china clay case appears in the Northern Irish Reports for July—*Re Marion Chichester Clark Estate* (1937) N.I.Rep.98. This estate was taken over under the North Ireland Land Act, 1925, which contains a provision similar to the Railway Acts that where lands are conveyed to the Land Purchase Commissioner under the compulsory purchase scheme, "minerals" are excluded and do not vest in the commission but remain in the owner. In this case the owner applied for an order declaring that the right to a substance which was found in the subsoil known as "Kieselguhr" or Diatomite should be excluded from the vesting. This substance is said to be in its origin formed at the bottom of lakes as a protective covering for small marine plants. It differs from clay in that clay is an integral part of the soil but diatomite is not. The same observation applied to "china clay" in the Great Western Railway Company's case. Some readers may be interested to know that diatomite is used as an absorbent of nitroglycerine, and also in the manufacture of waterglass, abrasive soaps, and discs for gramophone records. Mr. McGaw, K.C. (sitting as Judicial Commissioner) followed the *Great Western Railway Company's case* and held that diatomite was a mineral and that the owner retained her rights to it on conveyance of the surface land to the commissioners.

Injury to Child Trespassing

Proctor v. *British Northrop Loom Co. Ltd.* *"The Times,"* July 21.

A little girl of nine got through a gate on to a railway embankment and so through a gap and on to a piece of waste land belonging to the defendants. She fell down a deep hole there and was injured, and the jury awarded her £376 damages. The Court of Appeal took a more critical view and entered judgment for the defendants on the ground that the owners were under no duty to make the land safe for trespassers. Landowners must not lay a trap for trespassers, but it is only towards persons "invited" to come or allowed to come that the higher duty arises.

The defendants had done everything to warn people not to come on to the land, and the girl knew that she ought not to be there. The case closely resembles *Hardy* v. *Central London Railway Company* (1920), 3 K.B.459, in which children were injured in running up and down the company's moving staircase. The Court of Appeal there too held that there was no liability on the railway company, because the company could not be said to have permitted children to resort to the booking office as a playground or for any purpose not connected with the use of the railway. In frequenting the booking office the children were doing what was forbidden. Stress is always laid in cases of this kind on *Cooke* v. *Midland Great Western Railway* (*Ireland*), where it was held that where there is an "allurement" on the land which is a source of danger to children, the company ought to take steps to counteract the attraction or to minimise the danger. But the ordinary rule is that a person trespasses at his own risk, and once it is found that the plaintiff is a trespasser, judgment should be in favour of the defendants.

Canadian Railways and Floods

Rex v. *Southern Canada Power Company* (1937) 3 All.E.R.923.

It has taken nearly ten years for the Courts to come to a final decision in the *Canadian National Railways case*, in which, under the ægis of the Crown representing the Dominion of Canada, the company claimed for damage to its embankment and train caused by floods in the spring of 1928. The damage was due to the breaking of a dam constructed by the Southern Canada Power Company under a statute by which the owner or lessee was to be liable for any damages caused as a result of the construction of the dam. The damage was due to a rush of ice and water, which came down the St. Francis River and collected in the basin above the dam, known as the Hemming Falls Dam. The jam of ice gave way at 3 p.m. on Easter Day and rushed over the dam, overwhelming the railway embankment which was below. A train was coming along at the time and the engine and two cars plunged into the water; but owing to the promptness of a woman named Madame Groucher who lived near the line and ran to warn the engine driver, a much greater disaster was averted, for the driver had time to put on the brakes and hold up the rest of the train short of the gap. On the question of liability for the damage *Greenock Corporation* v. *Glasgow & S. Western Railway Company*, 1917, A.C.556, was cited as showing that anyone who obstructs the natural flow of the river is liable at common law if damage results. Contributory negligence will not limit this liability, which is absolute. What was the position under this and similar statutes having regard to the clause as to liability for damage? Is contributory negligence a good answer to such a claim? The answer seems to depend on the degree of negligence involved. This spring flood is of annual occurrence on the St. Francis River, and there was no reason to anticipate any extraordinary floods in 1928. Here the power company which had constructed and was responsible for the dam was held to be liable, and the Courts found that there was no contributory negligence on the part of the railway company. But that leaves still open the question whether negligence on the part of the plaintiffs themselves can be pleaded as an answer to claims under the statute for damages. The Privy Council whose judgment was given by Lord Maugham would go no further than to say that if the

claimants had acted "foolishly and irrationally" they could not have recovered.

But the plaintiffs (the railway company in this case) are only expected to behave as reasonable men. In the event of probable damage they are to take such precautions as reasonable men would take and to minimise the damage if an accident occurred. They could not be expected to foresee dangers which ordinary men would not foresee. The case suggests that, while the doctrine of contributory negligence is not excluded as a defence to a liability clause in an "enabling statute," it is only gross negligence which will be taken into account, and of this there must be strict proof by the defendants if they are to escape liability.

Inaugural Runs of the West Riding Limited, L.N.E.R.

On Thursday, September 23, a trial trip of the new L.N.E.R. West Riding Limited was made from Bradford and Leeds to Barkston and back, this destination being chosen, as on previous trials, because it enables the train to be worked round a triangle of lines between the south, east and north junctions in preparation for the return journey. The set of four twin articulated coaches (eight vehicles in all) described on page 557 of this issue weighed, with passengers, about 290 tons; the engine was class "A4" Pacific No. 4495, *Golden Fleece*, except between Bradford and Leeds, where the train has to reverse. For the 9½-mile run separating these cities standard class "N2" 0-6-2 tank engines will normally be used. Between Leeds, which was left at 2.45 p.m., and Newark the point-to-point timings of the new train were worked to. Out of Leeds Central the gradient is at 1 in 100 to Holbeck, 1 in 82 for over ½-mile beyond, and then, after ½-mile downhill, 1 in 100 for 3½ miles to Ardsley, making a difficult start; on the 1 in 100 speed fell from 44 to 35 m.p.h., and Ardsley, 5·6 miles, was passed in 9 min. 55 sec. Speed must then be kept at 50 m.p.h. down to Wakefield, beyond which is the severe slowing over Bridge No. 60, now in course of replacement, and immediately preceding the 3¾-mile rise at 1 in 150 to Nostell. Wakefield, 9·9 miles, was passed in 16 min. 1 sec., and milepost 170 (summit) in 24 min. 23 sec. (15·7 miles), speed having risen to 54 m.p.h. on the 1 in 150. Maximum on the descent to Doncaster was 80·3 m.p.h., Doncaster, 29·7 miles, being passed in 36 min. 36 sec., 1½ min. late (owing to the bridge slack). This loss was more than recovered, however, by running the 35·9 miles from Doncaster to Newark in 27 min. 14 sec.—a gain of 2¾ min. on schedule. Speeds were 71½ m.p.h. at Piper's Wood (up 2¾ miles at 1 in 198), 92 at Ranskill, a drop from 74 to 66 at Markham summit, up 3½ miles at 1 in 178-200, and 93½ sustained from Crow Park to Carlton.

In the reverse direction little of note occurred between Newark and Doncaster, the 35·9 miles taking 31 min. 15 sec., but good work was done on the subsequent climbs, with 70½ m.p.h. sustained to South Elmsall (up 1 in 206), 68 to Hemsworth (up ¾-mile at 1 in 189 and 1¾ miles at 1 in 152), and 68 to Nostell summit (up 1¼ miles at 150), the entire climb of 7·6 miles from Hampole to milepost 170 taking 6 min. 23 sec. The acceleration from the severe Wakefield slack to 49½ m.p.h. at Lofthouse, almost exclusively up an ascent of 1 in 100, was also good, and the final 1½ miles at 1 in 122 to Ardsley were surmounted at 48½ m.p.h. So the 19·8 miles from Doncaster to Wakefield were covered in 19 min. 46 sec. (including the bridge check), and the 9·9 miles from Wakefield to Leeds, including the usual check to walking pace through Holbeck, in 13 min. 27 sec., Leeds being reached about a minute before time. A number of distinguished guests, including the Lord Mayor of Leeds, travelled on the train, and much appreciative comment was heard on the originality and comfort of its internal equipment, as well as on the smoothness and noiselessness of the riding.

On the first regular up journey, on Monday last, a complement of about 150 passengers was carried, and although, because of the bridge check at Sandal, Doncaster was passed 2 min. late, King's Cross was reached 2 min. before time, at 2.13 p.m. The engine was No. 4492, *Dominion of New Zealand*, and the highest speed attained was 97 m.p.h., at Essendine. The first down journey, however, was not so fortunate, as owing to signal checks the arrival in Leeds was 14¼ min. late. A log of the run, which had some remarkable performance features, is given herewith; the engine was again No. 4492. In the early stages, a striking achievement was the steady acceleration, with the 290-ton train, from 60 to 68 m.p.h. up the 7¾ miles at 1 in 200 from Wood Green to Potter's Bar; then came the maintained 85 m.p.h. from Hatfield up 1 in 200 till the slight slack at Woolmer Green, the maximum of 98 m.p.h. at Three Counties, a fall only from 77 to 72½ m.p.h. up 3¼ miles at 1 in 200 beyond Huntingdon, and 92 m.p.h. at Holme. The 62·3 miles from Potter's Bar to Fletton Junction were thus completed at an average of 85·4 m.p.h., and Peterborough, 76.4 miles, was passed in 61 min. 5 sec., 2½ min. early. Another outstanding feat was the acceleration from 85 m.p.h. at Tallington, up continuously rising grades, largely 1 in 264, to 88 at Essendine, the maintenance of the same speed up the 1 in 264 beyond, and then no fall below 85½ up 1½ miles at 1 in 200 to Little Bytham. Immediately after this came a dead stand of 1 min. 48 sec. for signals, which cost fully 6½ min. in the running, involving, as it did, recovery up 1 in 200 and 1 in 178 grades to Stoke. Subsequently the best work was seen in the minimum of 69 m.p.h. at Markham (up a 6½-mile bank including 4½ miles at 1 in 200), and a drop only from 82 to 76½ m.p.h. up 1½ miles at 1 in 198 from Bawtry; up the 1 in 152 to Hemsworth the minimum was 60 m.p.h. and up the 1 in 150 to Nostell 65 m.p.h. Signals were again adverse approaching Doncaster, and the train was stopped for the second time at Sandal for 3 min. 30 sec., and badly checked thereafter. From King's Cross to milepost 95, the 95.0 miles were run in 77 min. 5 sec.—a start-to-stop average of 73.9 m.p.h., including the slowing through Peterborough—and from milepost 95 to Sandal the 79.1 miles took 70 min. 42 sec., or 69¾ min. net, including Doncaster service slack. Net times from King's Cross were 85 min. to Grantham (105.5 miles), 125¼ min. to Doncaster (156.0 miles), and as nearly as can be estimated 159 min. for the 185.7 miles to Leeds—a net average of exactly 70 m.p.h. throughout.

The up journey on the second day, September 28, was one of the most

L.N.E.R. WEST RIDING LIMITED

Engine: 4-6-2 No. 4492, *Dominion of New Zealand*.
Load: 8 cars, 278 tons tare, 290 tons gross.

Distance		Sched.	Actual	Speeds
miles		min.	min. sec.	m.p.h.
0·0	KING'S CROSS	0	0 00	—
2·5	FINSBURY PARK	—	5 14	49
5·0	Wood Green	—	9 17	61
12·7	Potter's Bar	—	15 05	68
17·7	HATFIELD	18½	18 55	85
23·5	*Woolmer Green*	—	23 04	85/*77
28·6	Stevenage	—	26 50	82
31·9	HITCHIN	29½	29 07	90
37·0	Arlesey	—	32 23	98/92
44·1	Sandy	—	36 55	95½/92
51·7	St. Neots	—	41 59	85
56·0	Offord	—	45 03	*77
58·9	HUNTINGDON	48½	47 19	*77
63·5	Abbots Ripton	—	50 59	72½
69·4	Holme	—	54 56	92
75·0	*Fletton Jc*	—	58 50	83½
76·4	PETERBOROUGH	63½	61 05	*22
79·5	*Werrington Jc.*	—	65 09	64
84·8	Tallington	—	69 26	85
88·6	Essendine	—	72 07	88
92·2	Little Bytham	—	74 31	86½
95·0	*Milepost* 95	—	{ 77 05 / 78 53 }	*sig.* / *stop*
97·1	Corby	—	83 29	51
100·1	*Stoke*	—	86 57	53½
105·5	GRANTHAM	87½	91 33	*74
109·7	Barkston	—	94 45	90
111·5	Hougham	—	96 10	*70
115·4	Claypole	—	99 05	90
120·1	NEWARK	99½	102 21	*76
126·4	Carlton	—	107 05	85
133·7	*Markham*	—	112 48	69
138·6	RETFORD	114½	116 38	86½/*54
143·9	Ranskill	—	121 18	88
149·5	*Milepost* 149½	—	123 38	76½
151·3	Rossington	—	126 44	85
			sigs.	25
156·0	DONCASTER	129	132 38	*30
162·4	Hampole	—	139 10	76½
167·8	Hemsworth	—	143 56	60/67
170·3	Nostell	—	146 16	65
171·8	Hare Park	—	147 26	83½
174·1	Sandal	—	{ 149 35 / 153 05 }	*sig.* / *stop*
			sigs.	10
175·8	WAKEFIELD	148	161 15	—
180·1	Ardsley	154½	167 59	47
183·2	Beeston	—	171 09	65
			sigs.	
185·7	LEEDS	163	177 21	—

* Speed reduction

brilliant feats of locomotive performance ever yet recorded on L.N.E.R. metals. The engine was again No. 4492, and the load 295 tons gross. Owing to very cautious running in the early stages, including the slack over Bridge No. 60, the train passed Doncaster nearly 3 min. late, the time from Leeds being 37 min. 56 sec. for the 29·7 miles. But from Doncaster to King's Cross the 156·0 miles were covered in 122 min. 29 sec., the 144·5 miles from milepost 149½ to Wood Green occupying no more than 109 min. 45 sec.; the average of 79·2 m.p.h. for the entire distance included a slack to 26 m.p.h. through Peterborough, and eight other slowings. Some very high speeds were reached, including 100 m.p.h. at Crow Park and 101 m.p.h. near Essendine (12 miles here were run at an average of 93·3 m.p.h.), but the most exceptional features of the running were uphill. After easing to 68 m.p.h. at Hougham, the driver maintained that speed up 1 in 200 to Peascliffe tunnel, and 72 m.p.h. was kept up without intermission on the 1 in 200 from Grantham to Stoke tunnel; also the 4½ miles up at 1 in 200 past Abbots Ripton were begun at 82 and ended at 75 m.p.h. Then a speed of 93½ m.p.h. was attained on the level at Biggleswade, dropping merely to 90 up 2 miles at 1 in 330-264 to Langford, and increasing to 92½ on the slight dip past Arlesey; at Hitchin, after 2½ miles up at 1 in 264-200, speed was still 85½ m.p.h., and the 3½ miles at 1 in 200 from there up to Stevenage were mounted steadily at 81½ m.p.h., giving the astonishing average of 86·6 m.p.h. up the unbroken 8·4 miles' climb from Arlesey.

The speed reductions were from 75 to 69 m.p.h. for Scrooby troughs, from 82 to 65 m.p.h. at Retford, from just under 100 to 71 m.p.h. for Muskham troughs, from 82 to 68 m.p.h. for Hougham, from 96 to 64 for Werrington troughs and to 26 m.p.h. through Peterborough, from 81 to 71 m.p.h. for Offord curves, from 82 to 74 m.p.h. for Langley troughs, and from 87 m.p.h. at New Barnet to a cautious run in from New Southgate to the terminus, reached 3½ min. early. From Doncaster to Retford the 17·4 miles took 14 min. 51 sec. (booked 15); from Retford to Newark, 18·5 miles, 14 min. 4 sec. (15); from Newark to Grantham, 14·6 miles, 11 min. 28 sec. (12); from Grantham to Stoke summit, 5·4 miles, 4 min. 33 sec., and to Peterborough, 29·1 miles, 21 min. 32 sec. (23½); from Peterborough to Huntingdon, 17·5 miles, 15 min. 17 sec. (15); from Huntingdon to Hitchin, 27·0 miles, 18 min. 45 sec. (21); from Hitchin to Hatfield, 14·2 miles, 10 min. 28 sec. (11); and from Hatfield to King's Cross, 17·7 miles, 16 min. 4 sec. (16½)—a steady gain on schedule throughout, and a total gain of 6½ min. from Doncaster. Driver Long, of King's Cross shed, was responsible for this record performance, which was timed by Mr. R. E. Charlewood.

The New Station at Wellington, New Zealand

In our issue of April 5, 1935, we gave a brief history of the predecessors of the new station at Wellington, and in that of November 10, 1933, and November 1, 1935, were described various features of the new structure and layout, which, as recorded on page 44 in our issue of July 2, 1937, were opened for public traffic on June 19 last. Since the trade and financial recovery in the Dominion, however, it has been found necessary to enlarge the office accommodation in the main block of buildings, on the lines indicated below, where it is also now possible to give a few other details not hitherto available. In the new locomotive yard are a 70-ft. turntable, mechanical ash-handling plant, and coaling plant, having an overhead bin with a chute on each side, up to which wagons will be hauled by electric winch. There are also separate "in" and "out" electric roads and a sand-drying shed into the overhead bins of which the sand is lifted by compressed air. The running shed covers over an acre of ground, and is of the double-ended type; special bays are reserved for electric locomotives. There is a separate railcar shed nearer the passenger station, which is designed to accommodate, eventually, 20 cars. In the carriage yard a steam boiler with a reticulation through the yard and extending to the platforms, provides steam for carriage heating and for drying purposes.

The Station Building

Now that they are completed the new station buildings are very handsome, as may be seen from the illustration on page 560, which shows them floodlit for the Coronation. The interior of the booking hall, too, is most imposing. The floor is of terrazo with brass edgings, and the lower walls are of marble; the lofty arched roof is of fibrous-plaster in deep panels. Leading out of the booking hall, through a lobby, is a fine well-lit concourse with arched glazed roof, and neat finish in tiles and plaster work. As well as a train indicator it contains an electric informator supplying general information; loudspeakers also make train announcements. But perhaps one of the most striking features of this new station is the provision of a crèche and playroom for children, enabling mothers visiting the capital for shopping or amusements, to leave their children in the care of trained kindergarten staff at the station for a small charge. There is a sleeping room for babies, an outdoor roof playground, playroom, and kitchen for preparing simple meals. Owing to the lower prices ruling when materials were purchased, a saving was effected on the estimates, and this has been devoted to increasing a wing of the building from one to five stories in height, within the original estimated cost. These extra stories accommodate the offices of the outdoor advertising and road motor services clerical staffs, and improve the appearance of the building as a whole. An electric power house and substation distribute and transform down the 11,000-V. current from the city mains to 400/230 V. for general purposes, and to 3,300 V. for the signalling installation.

Electric Equipment and Signalling

The electric equipment of the new station building includes lighting, heating, cooking, and power for calculating machines, motors circulating hot water for heating, clocks, automatic telephones and eight lifts. Great care has been bestowed upon the lighting arrangements, and, in all, over 50 motors are installed. The illumination of the dials of the two outside clocks are controlled by an electric eye, which automatically switches on the lighting when daylight fades. The whole of the two-mile long yard is, with the exception of a few points and signals in the goods sidings, controlled by an all-electric signalling plant. There is only one signal box, containing 127 levers; the signals are of the three-position colour-light type, and the points are motor operated. The locking frame is in three panels, above which is an illuminated diagram showing the positions of trains throughout the yard, and behind each miniature lever is an indicating repeater lamp. Interlocking is also electric, and track-circuit protection is provided for all train movements. There are 70 point motors, each point movement being completed in three seconds; to ensure that points cannot be moved while a train is passing over them, the power to the motor is automatically cut out. Electric detection is also provided, ensuring that the correct sequence of movements and right road are given, and that nothing is out of adjustment or order, before the relevant signal can come off. Telephonic train control is also installed in which any station within the wide control area can speak to the control officer through a loud-speaker without the necessity of the officer using a telephone receiver. Teleprinters are also to be installed in this office so that letters typed on a machine in Wellington will be reproduced on the machines at other stations, namely Wanganui and Auckland in the first instance. From these few notes it will be evident that this fine new station is remarkably well adapted for efficient operation, and replete with every kind of up-to-date equipment.

SHROPSHIRE UNION CANAL.—The proposal of the L.M.S.R. to close the Welsh section of the Shropshire Union Canal from its terminus at Newtown (Montgomeryshire) to Frankton (Salop), a distance of 36½ miles, is being opposed by the Salop County Council.

NOTES AND NEWS

Demolishing a Rhine Bridge.—Before the end of the present year work will be begun on the demolition of the Rhine railway bridge at Huningue, over which traffic is very light following the transfer of Alsace from Germany to France.

Railway Officers' and Servants' Association.—The Rt. Hon. Lord Cadman, G.C.M.G., D.Sc., has consented to preside at the 76th anniversary festival in aid of the funds of the United Kingdom Railway Officers' and Servants' Association. The festival is to be held at the Trocadero Restaurant, Piccadilly Circus, on Wednesday, October 20.

Railway Staff Conference.—Today, October 1, the offices of the Railways Staff Conference, the Railway Staff National Council, and the Special Joint Committee on Machinery of Negotiation for Railway Staff, are being transferred from 35, Parliament Street, S.W.1, to Fielden House, Great College Street, Westminster, S.W.1. We are advised by Mr. Frank Gilbert, the Secretary, that the new telephone number will be Whitehall 6146.

Re-housing L.M.S.R. Tenants Displaced by Euston Station Reconstruction.—The first stage of an £86,000 scheme to re-house residents in the vicinity of Euston station, who as tenants of the L.M.S.R., will be displaced when the station is rebuilt under the impending scheme, will be undertaken on Thursday, October 7. At 3.15 p.m., Sir Josiah Stamp, Chairman of the L.M.S.R., is to lay the foundation stone of an extensive estate of five blocks of flats at York Rise, Highgate Road, N.W.5, which are being erected by the St. Pancras House Improvement Society Limited, on behalf of the L.M.S.R., to accommodate the displaced tenants.

The Storstrøm Bridge.—As the opening of the Storstrøm bridge necessitated considerable alterations in the railway timetables, it was decided to introduce the winter service on the following day, a little earlier than usual. The gain in journey time due to the direct railway connection is well shown by the improved running of the expresses Nos. 121, 145, 132, and 100, making connections between Copenhagen, Hamburg, and Berlin, amounting to a saving of 50 min. in some cases. The night train No. 100 has, however, been accelerated by only 3 min. as it reaches Copenhagen at 6.48 a.m., which is considered quite early enough for passengers' convenience. These four trains will be the first expresses to run fitted with air instead of vacuum brakes, being hauled by locomotives acquired from Sweden when electrification was extended there. More fast trains have been put on than in previous winters and the express railcar service between Copenhagen and West Jutland (Esbjerg), originally intended to run only in the summer, is to continue in service, having proved very popular.

The Post Office Tube Railway.—To commemorate the 10th anniversary of the opening of the Post Office underground railway in London, the Post Office has issued Green Paper No. 36 describing the construction, operation, and traffic of the line. This railway, which was begun just before the war, was used in its unfinished condition as a safe receptacle against air raids for various national treasures. It was opened in 1927, after having been built at a cost of approximately £1,750,000, and was described and illustrated in THE RAILWAY GAZETTE dated February 10, 1928.

Modernisation of Carnforth Station, L.M.S.R.—Extensive improvements to Carnforth station at a cost of £53,000, are to be carried out by the L.M.S.R. under the Government Loan scheme. The plans include the provision of a new platform 890 ft. in length, and the raising of the level of the existing platforms, the modernisation of the station accommodation, the laying down of new carriage sidings, and the replacement of Nos. 1 and 2 signal boxes. When these improvements are completed, the company expects that it will be able to provide better train services from Carnforth to the Furness area which, in addition to Barrow-in-Furness and the greater part of English Lakeland, includes the seaside resorts of Morecambe, Heysham, and Grange-over-Sands.

Temporary Sunday Closing of Southern Main Line.—The track in Polhill tunnel (between Knockholt and Dunton Green) is to be relaid with welded rails, 180-ft. long, similarly to the work recently carried out in Merstham Quarry tunnel and described in THE RAILWAY GAZETTE of July 16 (page 115). Other important engineering work is being carried out at Hildenborough, and it will therefore be necessary to close the line between Knockholt and Tonbridge on Sundays during October. On these four days those main-line steam trains to Tunbridge Wells Central, Hastings, Ashford, Folkestone, Dover, Deal, &c., which normally run via Orpington and Sevenoaks, will be diverted to other routes. Electric trains between London and Sevenoaks (via Orpington) will be reversed at Knockholt, and a bus service will run in connection between Knockholt and Sevenoaks, calling at Dunton Green, at approximately half-hourly intervals. A local train service will be arranged between Sevenoaks (Tub's Hill) and Dunton Green, with connections to and from the Westerham branch. The advertised service to and from Knockholt, Dunton Green, Sevenoaks (Tub's Hill), Hildenborough, and Tonbridge will be replaced by a special bus service for the convenience of passengers travelling to or from stations below Tonbridge. On Sunday, October 31, the normal electric train service between London and Sevenoaks will be in operation, and for passengers travelling to Hildenborough, Tonbridge, and beyond the same arrangements will apply as on the four previous Sundays.

Large Northants. Farm Removal.—Nearly 500 animals were involved in a farm removal carried out by the L.M.S.R. on Tuesday last, September 28, when the entire contents of a farm at Towcester, near Northampton, were moved by special train to Newark, between Nottingham and Lincoln. Included in the 500 animals were 100 milking cows which could not be moved until after milking time on Tuesday, and which had to be at their new destination in time for milking the following morning. In addition to the livestock, there were four containers of furniture and 20 tons of farm implements to be moved.

New Pickfords Depot in Isle of Wight.—Sir Herbert Walker, General Manager of the Southern Railway and a Director of Pickfords, Limited, opened on September 23 the new Goods Depot which Pickfords Limited has built at Cowes, Isle of Wight. The large gathering included many business men interested in transport services to the island. The depot, which is situated on the west side of the river Medina, has cost nearly £19,000. It comprises a wharf with a water frontage of 187 ft., extensive loading platforms and electric cranes, and adequate storage accommodation, in addition to general offices and a staff mess room. This new depot is an essential feature of a co-ordinated road and rail system which has been adopted to give quick delivery by road to all parts of the island, and to avoid the separate handling of small packages after their dispatch from the mainland at Portsmouth.

The First Diesel.—A meeting organised by the M.A.N. is to take place at Augsburg on Monday next, October 4, in connection with the unveiling of the first diesel engine, built in Germany 40 years ago. The ceremony, which takes place at 11 o'clock in the morning, and to which a large company of engineers and others has been invited, is to be followed by a lunch at the Drei Mohren Hotel, Augsburg, and after that there will be a tour of the M.A.N. works, and a reception at the Town Hall, when the famous gilded chamber will be inspected. The complete function is referred to as the "Fortieth Diesel-Engine Anniversary Celebrations." An address of welcome will be given by Director Otto Meyer, of the M.A.N., and a ceremonial speech by Director Walther Winterle. These are to be followed by a musical programme given by the Münich Philharmonic Orchestra under the direction of Siegmund von Hausegger. In addition, there will be a tour of the city of Augsburg.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 38th Week			Totals to Date		
	1937	1936	Inc. or Dec.	1937	1936	Inc. or Dec.
L.M.S.R. (6,870¼ mls.)	£	£	£	£	£	£
Passenger-train traffic...	538,000	533,000	+ 5,000	20,343,000	19,569,000	+ 774,000
Merchandise, &c. ...	516,000	497,000	+ 19,000	18,504,000	17,977,000	+ 527,000
Coal and coke ...	262,000	230,000	+ 32,000	9,569,000	9,025,000	+ 544,000
Goods-train traffic ...	778,000	727,000	+ 51,000	28,073,000	27,002,000	+ 1,071,000
Total receipts	1,316,000	1,260,000	+ 56,000	48,416,000	46,571,000	+ 1,845,000
L.N.E.R. (6,315 mls.)						
Passenger-train traffic...	347,000	344,000	+ 3,000	13,324,000	12,737,000	+ 587,000
Merchandise, &c. ...	348,000	335,000	+ 13,000	12,709,000	12,248,000	+ 461,000
Coal and coke ...	256,000	239,000	+ 17,000	9,290,000	8,725,000	+ 565,000
Goods-train traffic ...	604,000	574,000	+ 30,000	21,999,000	20,973,000	+ 1,026,000
Total receipts	951,000	918,000	+ 33,000	35,323,000	33,710,000	+ 1,613,000
G.W.R. (3,738¼ mls.)						
Passenger-train traffic...	225,000	220,000	+ 5,000	8,599,000	8,361,000	+ 238,000
Merchandise, &c. ...	209,000	203,000	+ 6,000	7,528,000	7,226,000	+ 302,000
Coal and coke ...	108,000	97,000	+ 11,000	4,208,000	3,767,000	+ 441,000
Goods-train traffic ...	317,000	300,000	+ 17,000	11,736,000	10,993,000	+ 743,000
Total receipts	542,000	520,000	+ 22,000	20,335,000	19,354,000	+ 981,000
S.R. (2,157 mls.)						
Passenger-train traffic...	321,000	306,000	+ 15,000	12,801,000	12,159,000	+ 642,000
Merchandise, &c. ...	70,000	72,000	− 2,000	2,339,500	2,398,500	− 59,000
Coal and coke ...	30,000	29,000	+ 1,000	1,123,500	1,154,500	− 31,000
Goods-train traffic ...	100,000	101,000	− 1,000	3,463,000	3,553,000	− 90,000
Total receipts	421,000	407,000	+ 14,000	16,264,000	15,712,000	+ 552,000
Liverpool Overhead ... (6½ mls.)	1,286	1,128	+ 158	49,713	45,595	+ 4,118
Mersey (4½ mls.) ...	4,087	4,026	+ 61	158,295	153,215	+ 5,080
*London Passenger Transport Board ...	568,300	575,500	− 7,200	7,236,200	7,234,500	+ 1,700
IRELAND						
†Belfast & C.D. pass. (80 mls.)	2,401	2,551	− 150	104,900	106,161	− 1,261
,, ,, goods	387	457	− 70	18,184	20,631	− 2,447
,, ,, total	2,788	3,008	− 220	123,084	126,792	− 3,708
Great Northern pass. (543 mls.)	11,500	11,750	− 250	437,050	425,850	+ 11,200
,, ,, goods	9,750	9,450	+ 300	356,000	370,000	− 14,000
,, ,, total	21,250	21,200	+ 50	793,050	795,850	− 2,800
Great Southern pass. (2,076 mls.)	37,554	39,183	− 1,629	1,437,060	1,426,467	+ 10,593
,, ,, goods	41,532	41,285	+ 247	1,544,323	1,572,841	− 28,518
,, ,, total	79,086	80,468	− 1,382	2,981,383	2,999,308	− 17,925

* 13th week (before pooling) † 39th week

RAILWAY AND OTHER REPORTS

San Paulo (Brazilian) Railway.—An interim dividend of 2 per cent., tax free, on the ordinary stock is announced, the same as at this time a year ago. This dividend and the half-yearly distribution of 2½ per cent., less tax, on the 5 per cent. non-cumulative preference stock, will be payable on October 22.

Barsi Light Railway.—Gross earnings for the year to March 31, 1937, were Rs. 15,34,964, against Rs. 19,26,216 for the previous year. A serious outbreak of cholera interfered with the attendance of pilgrims at the big Ashadi Fair in July, and the failure of the monsoon produced practically famine conditions in the company's area. Working expenses at Rs. 10,87,015 were Rs. 47,715 lower, and net earnings fell from Rs. 7,91,486 to Rs. 4,47,949. In sterling the net earnings, subject to certain additions and subtractions, amount to £33,651, against £54,304, and the ordinary dividend for the year is reduced from 4½ per cent. to 2½ per cent.

Stothert & Pitt Limited.—The report for the year ended June 30 last shows a profit, including dividend receivable from a subsidiary company, of £65,218, after allowing for tax, directors' fees, bank interest, &c. The sum of £14,200 is added to tax reserve, leaving £51,018, which, with £1,178 brought in, makes a total available of £52,196. Reserve takes £12,500, pension fund £1,500, and preference dividend £3,017. As already announced, the directors recommend a dividend of 10 per cent. for the year on the ordinary shares (including the additional capital subscribed in April, 1937) and a bonus of 2½ per cent., and propose to carry forward £11,742. The additional capital taken up amounted to £58,415.

Clayton Dewandre Co. Ltd.—The directors have declared an interim dividend of 3 per cent. on the ordinary shares. This dividend is at the same rate as that declared last year, but is payable on an increased capital.

British and Irish Railway Stocks and Shares

Stocks	Highest 1936	Lowest 1936	Prices Sept. 29, 1937	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	64¼	45½	66⅝	+1⅝
5% Con. Prefce. ...	126½	116⅝	116½	—
5% Red.Pref.(1950)	113	108½	109½	—
4% Deb.	119½	110½	105½	—
4¼% Deb.... ...	121	114	111	—
4½% Deb.... ...	129	121	116½	—
5% Deb.	141	124	128½	—
2½% Deb.... ...	79⅛	74	69½	—
5% Rt. Charge ...	136½	130	127½	—
5% Cons. Guar. ...	135¼	127⅝	124	—
L.M.S.R.				
Ord.	35⅝	17	32	+½
4% Prefce. (1923)	83	52½	75½	+½
4% Prefce. ...	92⅝	81	84	+1
5% Red.Pref.(1955)	109¼	103¼	106	—
4% Deb.	111⅝	105 9/16	102	+½
5% Red.Deb.(1952)	119⅝	115½	112½	—
4% Guar. ...	106⅝	101⅝	99½	—
L.N.E.R.				
5% Pref. Ord. ...	14	9	10	—
Def. Ord.	7¼	4⅜	5	—
4% First Prefce.	79¼	55¼	72	—
4% Second Prefce.	31⅞	18¼	29½	+1½
5% Red.Pref.(1955)	100½	77⅝	98	—
4% First Guar. ...	104½	98⅜	96	—
4% Second Guar.	99	90	90	+½
3% Deb.	85⅝	79	76	—
4% Deb.	109⅝	104½	101	+½
5% Red.Deb.(1947)	116¼	110½	108½*	—
4½% Sinking Fund Red. Deb.	111½	107½	108	—
SOUTHERN				
Pref. Ord.... ...	98⅝	82½	90½	—
Def. Ord.	27⅝	20⅛	21½	—
5% Pref.	120⅝	118½	113½	—
5% Red.Pref.(1964)	119⅝	115¼	113½	—
5% Guar. Prefce.	136	129½	125	—
5% Red.Guar.Pref. (1957)	120	115¾	114	—
4% Deb.	117 5/16	109½	104½	+½
5% Deb.	140	134	126½	—
4% Red. Deb. 1962–67	116½	110	106½	—
BELFAST & C.D.				
Ord.	9	4½	4	—
FORTH BRIDGE				
4% Deb.	107	105	101½	—
4% Guar. ...	107 5/16	104	100½	—
G. NORTHERN (IRELAND)				
Ord.	19½	9¾	6⅞	—
G. SOUTHERN (IRELAND)				
Ord.	63	41	32¼	—
Prefce.	65	46	40	—
Guar.	97¼	81	73	−½
Deb.	99¾	83¼	89	−½
L.P.T.B.				
4½% "A" ...	127¾	121	113½	—
5% "A"	138¼	133½	125½	—
4½% "T.F.A." ...	111½	108⅛	105	—
5% "B"	131¾	123¾	117½	—
"C"	112½	93	77	−1½
MERSEY				
Ord.	40¾	23	28½	−1
4% Perp. Deb. ...	103	98	97	—
3% Perp. Deb. ...	78	74⅝	74½	—
3% Perp. Prefce.	68⅞	63¼	66½	—

* ex dividend.

OFFICIAL NOTICES

The Institute of Transport Examinations 1938

NOTICE IS HEREBY GIVEN that the Graduateship and Associate Membership Examinations will be held in London and at other centres on Thursday, Friday and Saturday, April 28th, 29th and 30th, 1938.

The latest date for the deposit of forms of entry is March 1st, 1938 (January 1st if any exemptions are claimed). Full particulars, previous question papers (price 1s. per set, post free), and copies of a revised and enlarged edition of the booklet "The Institute of Transport Examinations: Notes for the guidance of candidates unable to attend preparatory courses" (price 2s. 6d. post free), may be obtained from the undersigned.

By Order of the Council,
A. WINTER GRAY,
Secretary

15, Savoy Street,
London, W.C.2.
August 17th, 1937.

OFFICIAL ADVERTISEMENTS

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to:—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

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CONTRACTS AND TENDERS

D. Wickham & Co. Ltd. has received an order from the North Western Railway of Uruguay for four No. 17A petrol-driven gang trolleys.

Locomotives for Brazil

The North British Locomotive Co. Ltd. has received an order from the San Paulo (Brazilian) Railway for four 2-8-4 tank goods locomotives, 5-ft. 3-in. gauge.

The Chinese Government Purchasing Commission, on behalf of the Ministry of Railways, China, has placed orders to the inspection of Messrs. Fox and Mayo with Wild Barfield Electric Furnaces Limited for one electric high-speed steel hardening furnace and with Holbrook Machine Tool Co. Ltd., for one 17-in. swing by 42-in. capacity tool-room lathe.

J. Baker & Bessemer Limited has received an order from the Central Argentine Railway for 440 carriage and wagon tyres.

The Kumardhubi Engineering Works has received orders from the North Western Railway of India for 22 spans of fabricated steel work for 44-ft. 9-in. plate girder spans.

Soc. Commerciale D'Ougrée has received an order from the Bombay, Baroda & Central India Railway Administration, to the inspection of Messrs. Rendel, Palmer & Tritton for the supply of 6,000 bearing plates.

The South Indian Railway Administration has placed the following orders to the inspection of Messrs. Robt. White & Partners:—

Wolverhampton Corrugated Iron Co. Ltd., 750 galvanised corrugated sheets.
Thos. Robinson & Sons Ltd., two woodworking machines.
J. Walsh (Birmingham) Limited, 10 tons of steel bars.

Whitelegg & Rogers Limited has received orders for six engine sets of Ajax grease lubricating equipment for new 0-8-0 type locomotives for the King Kan Railway, under construction by the North British Locomotive Co. Ltd., and eight engine sets of Ajax lubricating equipment for converting locomotives of the Buenos Ayres Western Railway from oil to grease lubrication.

Beyer, Peacock & Co. Ltd. has received an order from the Rhodesia Railways for five boilers for Consolidation type tender locomotives.

Wagons for S. Africa

C. M. Hill & Company, on behalf of S.A. des Ateliers de Construction de Familleureux, Belgium, has received an order from the South African Railways & Harbours Board for 300 four-wheeled cattle wagons, 3-ft. 6-in. gauge. This order is of an approximate value of £120,000.

A.C.E.C. (India) Limited has received orders from the Indian Stores Department for 11,880 yd. of paper insulated h.t. three-core cable.

Steel, Peech & Tozer Limited has received an order from the Great Western Railway of Brazil for 303 locomotive, carriage, and wagon tyres.

The Swiss Locomotive & Machine Works has received orders from the Indian Stores Department for 33 each of outer left-hand, middle, and outer right-hand nickel-chromium steel gear wheel rims.

Greaves, Cotton & Co. Ltd. has received an order from the Indian Stores Department (Electrical Section) for one 20-kW. oil-engine-driven, two 7-kW., two 5-kW., and one 2-kW. motor-driven generating sets.

Taylor Bros. & Co. Ltd. has received an order from the Antofagasta (Chili) & Bolivia Railway for 354 locomotive and wagon tyres.

Tenders are invited by the Egyptian State Railways Administration, receivable at the General Management, Cairo station, by November 2, for the supply of 100 perishable goods wagons (Ref. No. E.S.R. 1.14/71), and receivable November 9 for the supply of 10-ton open low-sided wagons (Ref. No. E.S.R. 1.14/76).

The Chief Controller of Stores, Indian Stores Department (Electrical Section), Simla, invites tenders, receivable by November 9, for the supply of one one-ton electric walking crane required for the North Western Railway at Moghalpura.

Diesel Railcars Required for India

The Chief Controller of Stores, Indian Stores Department (Electrical Section), Simla, invites tenders, receivable by November 20, for the supply of 11 diesel railcars and one spare power bogie, conforming to I.S.D. schedule of requirements No. 2174. Tender forms may be obtained from the Director General, India Stores Department (London).

The Chief Controller of Stores, Indian Stores Department (Electrical Section), Simla, invites tenders, receivable by November 9, for the supply of the following electrical materials, required for the North Western Railway at the Mechanical Workshops, Moghalpura:—

One 25-kW. and one 10-kW. oil-engine-driven portable generating sets for a.c. and d.c. supply.
One battery-charging equipment and one complete switchboard to control all the above equipment.

The Turkish State Railways Administration is calling for tenders, to be presented in Ankara by November 3, for the supply of locomotive and carriage tyres. Firms desirous of offering tyres of United Kingdon manufacture can obtain further details from the Department of Overseas Trade. Reference number T.Y. 19999/37 should be quoted.

Tenders are invited by the Iranian General Administration of Industry and Mines for the supply of locomotives, wagons, and weighing machines, required for mines. Specifications can be obtained from the Commercial Attache, Imperial Iranian Legation, Ling House, 10-13, South Street, London, E.C.2.

ANOTHER PICKFORDS ACQUISITION.—We are officially informed that Pickfords Limited is formally taking over today (October 1) the road haulage business of Kirkland of Derby. The undertaking, which includes eight vehicles and four "A" and four "B" licences, is being merged into the Heavy Haulage Department of Pickfords Limited.

Railway Share Market

The stock and share markets have been unsettled by the sharp fluctuations of New York markets and consequently Home railway stocks failed to keep best prices this week. Nevertheless, the junior stocks again attracted attention on the view that prices may show ready response if, as is hoped, the upward movement in traffics is accelerated strongly by the impending 5 per cent. increase in rates and fares. The receipts for the past week were considered very good in the market, particularly the L.N.E.R. gain of £33,000, although the L.M.S.R. figures show a rise of £56,000.

Steady buying of Great Western ordinary was reported, sentiment having continued to benefit from the hopes of a 4 per cent. dividend entertained by some market men. Having regard to the possibility that it might be decided to add to reserves, it may be prudent not to budget for more than 3½ per cent. Nevertheless, on this basis quite a satisfactory yield would be offered at the present price. L.M.S.R. ordinary was also active in response to the view that the railway may benefit most from the increase in transport charges. The 4 per cent. preference around 84 and the 4 per cent. 1923 preference around 75½, at which both appear to give rather generous yields, also attracted more attention, but, as in the case of most other stocks, best prices were not held. L.N.E.R. second preference transferred around 30. It is generally expected an increase over the ½ per cent. dividend paid for 1936 is in prospect, and earnings on the stock for the current year are estimated at around 1½ per cent. in the market. There is, however, much divergence of opinion as to the dividend rate likely, as it is possible a much heavier allowance for renewals may be necessary in the current six months than was the case in the first half of the year. London Transport "C" stock was again lower, pending the dividend announcement.

Argentine railway stocks showed a fairly general improvement owing to the near approach of the preference dividend decisions and the past year's results. Better demand was reported for B.A. Gt. Southern preference stocks and for those of the B.A. Western, while the ordinary were also better, as was Central Argentine. Moderate gains were shown by the preference and debenture issues of the latter railway. Elsewhere, San Paulo was not quotably affected by the interim dividend. American and Canadian Pacific stocks fluctuated.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1936-37	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1936	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1936	Prices: Lowest 1936	Prices: Sept. 29, 1937	Yield (See Note)
				£	£		£	£	£					
South & Central America	Antofagasta (Chili) & Bolivia	834	26.9.73	14,330	— 480	39	639,750	525,700	+ 114,050	Ord. Stk.	25	15¼	19	Nil
	Argentine North Eastern	753	25.9.37	10,943	+ 1,108	13	134,797	120,186	+ 14,611		12	2	10½	Nil
	Argentine Transandine	—	—	—	—	—	—	—	—	A. Deb.	54	45	85	411/16
	Bolivar	174	Aug., 1937	4,800	— 100	35	45,600	52,500	— 6,900	6 p.c. Deb.	9	5	8½	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	16	11½	15½	3¼
	Buenos Ayres & Pacific	2,806	25.9.37	78,846	+ 2,375	13	1,004,219	942,634	+ 61,585	Ord. Stk.	17½	6	10	Nil
	Buenos Ayres Central	190	11.9.37	$137,900	+ $700	11	$1,589,500	$1,351,700	+ $237,800	Mt. Deb.	31½	11	31	Nil
	Buenos Ayres Gt. Southern	5,084	25.9.37	125,744	+ 17,038	13	1,515,633	1,388,902	+ 126,731	Ord. Stk.	31¾	13¾	24	Nil
	Buenos Ayres Western	1,930	25.9.37	44,169	+ 5,110	13	581,143	498,996	+ 82,147	,,	29¾	11	20½	Nil
	Central Argentine	3,700	25.9.37	125,012	— 21,817	13	1,705,423	1,739,359	— 33,936	,,	32 32	8¾	21	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	21	4½	11½	Nil
	Cent. Uruguay of M. Video	980	1829.37	16,970	— 438	12	177,094	175,805	+ 1,289	Ord. Stk.	7¾	3	5	Nil
	Cordoba Central	1,218	25.9.37	28,410	+ 60	13	466,150	455,610	+ 10,540	Ord. Inc.	5	1	3½	Nil
	Costa Rica	188	July, 1937	24,688	+ 3,250	4	24,688	21,438	+ 3,250	Stk.	36½	32	34	57/8
	Dorada	70	Aug., 1937	16,900	—	35	122,400	112,200	+ 10,200	1 Mt. Db.	107	101½	104½	5¼
	Entre Rios	810	25.9.37	14,138	+ 391	13	181,114	160,026	+ 21,088	Ord. Stk.	17	6	10½	Nil
	Great Western of Brazil	1,092	25.9.37	7,800	+ 1,200	39	277,300	284,500	— 7,200	Ord. Sh.	½	5/16	½	Nil
	International of Cl. Amer.	794	July, 1937	$420,213	+ $109,517	31	$3,625,846	$3,307,205	+ $318,641	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	½	-/6	½	Nil
	La Guaira & Caracas	22½	Aug., 1937	5,080	+ 135	35	43,200	37,195	+ 6,005	Stk.	9	3	7½	Nil
	Leopoldina	1,918	25.9.37	26,778	+ 1,940	39	900,307	728,309	+ 171,998	Ord. Stk.	10½	3½	5	Nil
	Mexican	483	21.9.37	$267,900	+ $25,900	12	$3,544,400	$2,985,500	+ $558,900	,,	1¼	¼	½	Nil
	Midland of Uruguay	319	Aug., 1937	7,032	— 939	9	14,578	15,754	— 1,176	,,	1½	⅛	½	Nil
	Nitrate	384	15.9.37	7,660	+ 3,936	37	113,641	90,745	+ 22,896	Ord. Sh.	63/6	41/9	21¼	Nil
	Paraguay Central	274	18.9.37	$3,011,000	+ $220,000	12	$39,233,000	$31,079,000	+ $8,154,000	Pr. Li. Stk.	85	71	81½	7⅛
	Peruvian Corporation	1,059	Aug., 1937	92,587	+ 5,347	9	173,721	171,561	+ 2,160	Pref.	15	9	8½	Nil
	Salvador	100	18.9.37	¢11,200	+ ¢3,211	12	¢136,259	¢124,115	+ ¢12,144	Pr. Li. Db.	18	16	22½	Nil
	San Paulo	153½	19.9.37	$3,390	+ 7,829	38	1,255,475	1,124,170	+ 131,305	Ord. Stk.	86	46½	85½	5⅞
	Taltal	160	Aug., 1937	4,555	+ 930	9	7,495	6,150	+ 1,345	Ord. Sh.	11 5/32	14/-	1	10
	United of Havana	1,353	25.9.37	15,584	— 53	13	227,769	201,825	+ 25,944	Ord. Stk.	3¼	1	2½	Nil
	Uruguay Northern	73	Aug., 1937	794	+ 7	9	1,560	1,692	— 132	Deb. Stk.	5	3	6	Nil
Canada	Canadian National	23,766	21.9.37	832,828	— 14,385	38	28,039,583	25,706,394	+ 2,333,189	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	—4 p.c.	Perp. Dbs.	76	51	66½	6
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	104¾	99¾	100½	4
	Canadian Pacific	17,228	21.9.37	657,800	+ 4,400	38	20,065,800	19,054,600	+ 1,011,200	Ord. Stk.	16¾	10 15/16	9½	Nil
India†	Assam Bengal	1,329	10.9.37	36,397	+ 3,375	23	579,201	539,562	+ 39,637	Ord. Stk.	87¾	82¼	77½	3/32
	Barsi Light	202	31.8.37	2,850	— 397	22	57,262	53,760	+ 3,502	Ord. Sh.	77½	65½	46§	10⅞
	Bengal & North Western	2,111	10.9.37	61,573	+ 1,834	23	1,311,189	1,205,391	+ 105,798	Ord. Stk.	319	292 5/8	308	5 13/16
	Bengal Dooars & Extension	161	10.9.37	4,496	+ 710	23	60,818	56,157	+ 4,661	,,	127½	118	87½	6 5/16
	Bengal-Nagpur	3,268	10.9.37	170,925	+ 32,563	23	3,074,664	2,698,098	+ 376,566	,,	104	100¼	90½	4 7/16
	Bombay, Baroda & Cl. India	3,072	20.9.37	216,075	+ 23,025	24	4,152,825	3,832,500	+ 320,325	,,	114	110½	111½	5⅛
	Madras & Southern Mahratta	3,229	10.9.37	128,475	+ 2,083	23	2,499,802	2,470,583	+ 29,219	,,	116½	108½	108½	7⅛
	Rohilkund & Kumaon	546	10.9.37	11,569	+ 1,563	23	250,104	238,657	+ 11,447	,,	311	286	310	5 15/16
	South Indian	2,531§	10.9.37	117,892	+ 4,597	23	1,865,229	1,806,275	+ 58,954	,,	107½	102 5/16	101½	5 7/16
Various	Beira-Umtali	204	July, 1937	97,402	+ 29,426	43	774,298	645,518	+ 128,780	—	—	—	—	—
	Egyptian Delta	620	10.9.37	7,031	+ 171	23	104,195	95,329	+ 8,866	Prf. Sh.	2¼	1 5/8	1 5/8	Nil
	Great Southern of Spain	—	—	—	—	—	—	—	—	Inc. Deb.	1½	1⅛	3½	Nil
	Kenya & Uganda	1,625	Aug., 1937	198,117	+ 31,586	35	1,922,899	1,783,395	+ 139,504	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	50½	37	46	7 5/8
	Midland of W. Australia	277	July, 1937	10,245	+ 31	4	10,245	10,214	+ 31	Inc. Deb.	97	93½	95	4 5/16
	Nigerian	1,900	14.8.37	33,356	+ 5,446	20	966,172	565,554	+ 400,618	—	—	—	—	—
	Rhodesia	2,451	July, 1937	412,400	+ 109,751	43	3,764,458	2,887,519	+ 876,939	—	—	—	—	—
	South Africa	13,263	18.9.37	662,543	+ 46,604	25	15,542,128	14,898,566	+ 943,562	—	—	—	—	—
	Victoria	4,774	May, 1937	822,932	+ 43,220	48	9,342,068	8,986,232	+ 355,836	—	—	—	—	—
	Zafra & Huelva	112	July, 1937	9,085	—	35	89,945	57,843	+ 32,102	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16.

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchang has proved misleading, the amount being overestimated. The statements are based on the current rates of exchange and not on the par value

Diesel Railway Traction

Railcar Fuels

THE original experiments of Dr. Diesel were conducted with coal dust fuel, and although it was soon found necessary to change over to oil, interest in what may be termed a solid-fuel diesel has never entirely died out, and at the moment this principle is represented by the Rupa pulverised-coal engine. Even in what are generally known as diesel fuels there is a wide difference in the characteristics of oils from different bases and from different stages of distillation, and these have their effect on engine design as well as on operation and maintenance. For instance, the prevalence of pre-combustion chamber engines in certain districts is due partially to the type of fuel used. Oils distilled from lignite tar are being used as an experimental fuel in a few M.A.N.-engined railcars in Germany, and on the basis of b.t.u.'s per unit of output the fuel consumption is not greater than with normal oils. There has been no failure traceable to the fuel used, and there is no reduction in power, but there have been complaints about the disagreeable smell of lignite tar oil, and extra precautions have had to be taken to shut off the engine room and tanks from the passenger portion of the cars, and to prevent filling of the tanks in passenger stations. Alcoholic and naphthalene fuels are used a good deal in Czechoslovakia and mazout in the bigger types of engines in the U.S.S.R., but there are also non-liquid fuels, such as producer gas, which are coming to the fore with the ultra-nationalist movements of the present time. Charcoal, wood, coke and anthracite are used, but although the fuel bill usually is decreased considerably, maintenance and operating costs in some examples have been higher than with an oil engine, due mainly to trouble with the producer. On the other hand, the running of a producer gas engine is smoother and quieter—especially at idling or light load—than the diesel. For stationary work there is available a dual fuel engine—the Nordberg, which can burn either gas or oil without any change, and it is possible that smaller high-speed engines of this type will be evolved. Finally, the experimental Erren engine, the principles of which have been adapted to a Beardmore road transport diesel engine, can burn either hydrogen or oil.

Fuel Requirements

IN large diesel locomotives, at least, the type of engine employed is not usually dissimilar to those used in submarines, and for that reason the general requirements drawn up by the U.S.A. Naval Engineering Department for diesel fuels are of interest. These requirements are not intended to replace the existing rigorous specifications, but were intended more as a guide for investigation and improvement. In short- or long-time storage the fuel must have the minimum deterioration and physical separation, the minimum corrosive characteristics, and no fire hazard. It must be capable of being pumped from the storage tanks to the service tank without any pre-heating, whatever the weather conditions, and must flow freely through the engine fuel systems without clogging the filters. The ignition and other physical-chemical characteristics of the fuel must give easy starting in cold weather, and the burning qualities must produce the minimum of combustion knock together with the maximum power and economy with a clear exhaust. Maintenance and repairs to the engine which can be traced to the fuel should be almost non-existent, and the fuel should be investigated carefully for any tendency to cause carbonisation or gumming of the piston rings and atomisers. No wear on the injection system or engine details should be caused by abrasive or corrosive constituents of the fuel. Intensive investigation along these lines has resulted in the production of fuels suited to the different types of engines used by the U.S. Navy, and further work is in hand for the evolution of a fuel which will be suitable for all types of engines.

Diesel Developments in Brazil

ALTHOUGH the centre of diesel traction in South America is hardly moving north from Argentina, there is considerable activity in the application of oil engines to railcars, trains and locomotives in Brazil, a country which hitherto has had only a handful of diesel vehicles. Of those in existence, the most notable is the Sao Paulo Railway's three-car 450 b.h.p. train *La Cometa*, built by Armstrong-Whitworth. There are two Leyland-engined cars of 90 b.h.p. on the metre-gauge Mogyana Railway, and isolated units on the Parana-Santa Catharina Railway (150 b.h.p. M.A.N. engine), Goyaz Railway (150 b.h.p. M.A.N. engine), and the Sao Luiz-Therezina Railway (110 b.h.p. M.A.N. engine). In 1936 the Central Railway of Brazil ordered five twin-car non-articulated Littorina sets from Fiat, and, as recorded on page 416 of our issue for September 3 last, this company contemplates the adoption of 30 heavy diesel-electric locomotives for freight trains, and also of a number of diesel trains for interurban passenger work. The Sao Paulo line has been so satisfied with the results given by *La Cometa* that last year it ordered two further trains from Armstrong-Whitworth, to be powered by 600 b.h.p. supercharged Armstrong-Sulzer engines, and these trains will be finished about the beginning of 1938. The English Electric Co. Ltd. is building a 450 b.h.p. diesel-electric locomotive for the Eastern Railway, which is centred on Bahia. Another interesting development is taking place on the Sorocobana Railway, which is acquiring two three-car diesel-mechanical trains for fast passenger traffic on its metre-gauge system. Each of these rakes is to be powered by two 275 b.h.p. Deutz horizontal engines and will have Mylius five-speed gearboxes. The top speed will be 65 m.p.h.

THE MAINTENANCE OF STREAMLINERS

Details of the organisation required for cross-continent diesel trains

A DESCRIPTION of the servicing and maintenance methods introduced for two of the high-speed diesel-electric trains in the U.S.A. were given at a recent meeting of the Pacific Railway Club, San Francisco. They dealt with the Super-Chief train of the Atchison, Topeka & Santa Fe Railroad, which as it now stands is an eight-car stainless steel set hauled by a 3,600 b.h.p. twin-unit locomotive, and the 11-car City of San Francisco train, owned by the Union Pacific Railroad and worked by that line in conjunction with the Southern Pacific. Both types have Winton two-stroke oil engines.

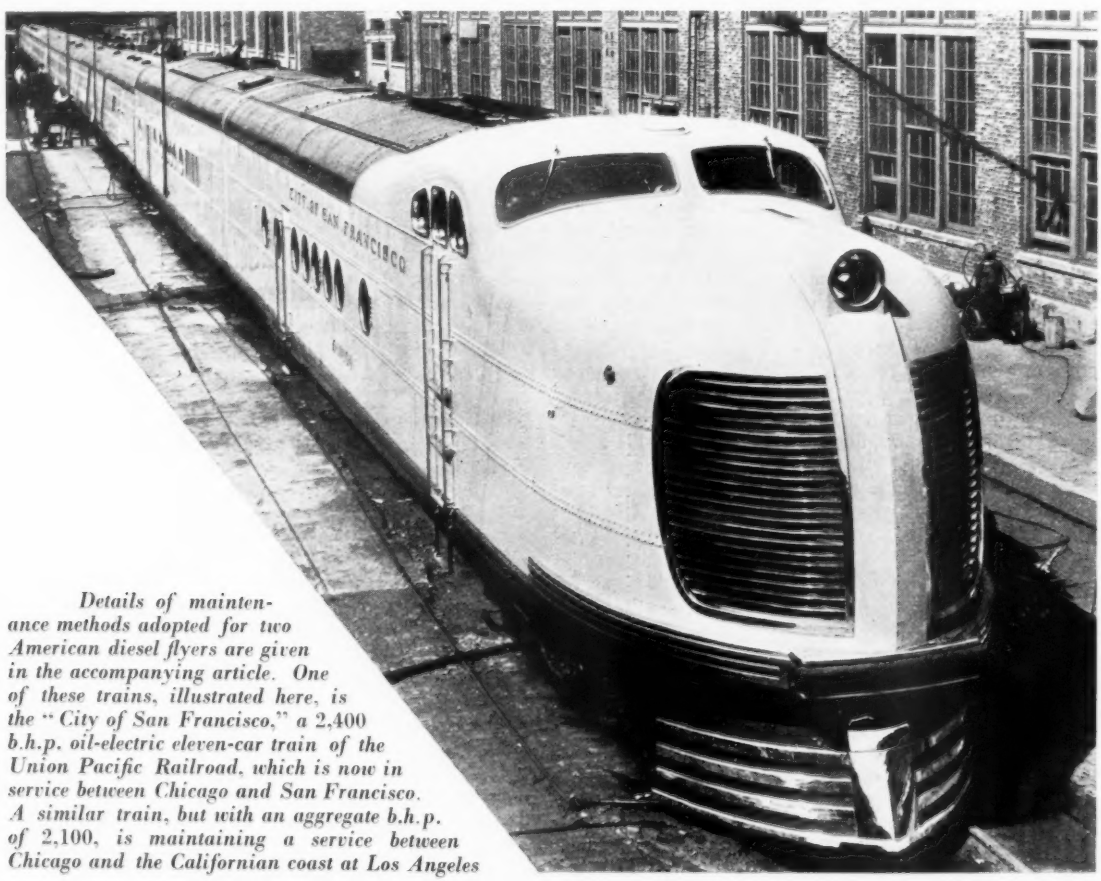
The Super-Chief

The new Santa Fe diesel locomotive is making end to end runs in excess of 2,000 miles, and monthly mileages of 25,000. The service stops between Chicago and Los Angeles are very short, being of 10 min. duration at the three points where supplies are taken in either direction.

Four trained mechanics having full knowledge of diesel construction and maintenance are in charge of the locomotive and train while *en route*. Two of the four are with the locomotive at all times between Chicago and Albuquerque, and two between Albuquerque and Los Angeles. When they arrive at the Chicago or Los Angeles terminal they work with and supervise mechanics during the lay-over period, preparing and testing the equipment for the return trip.

Upon arrival at Chicago off the eastbound run the units are inspected and prepared. The wheels, all parts of the underframe, trucks and brake gear are examined for defects. The main engine lubricating oil is analysed with a viscosimeter and, if it does not come strictly up to specifications, is changed. All crankcases and main and connecting-rod bearings are inspected. All pistons are inspected through scavenging-air ports in the cylinder walls, and if any sticking rings show up the piston is pulled and the rings freed. Every 50,000 miles of operation each piston is pulled for close measurement and inspection. Liner wear is measured at this time and liners changed if worn to the prescribed limit of $\frac{3}{64}$ in. All cylinder heads are examined and fuel lines tested for leaks. Each traction motor is opened and inspection made of armature, commutator, brushes, leads and field coils. Motor-suspension bearings are oiled and roller bearings are given an oil supply if needed. On each round trip all the motor bearings are greased. All generator and exciter brushes are examined and all power switches and control apparatus are cleaned and adjusted.

On annual inspection the main air reservoirs are given hydrostatic and hammer tests, and all power circuits



Details of maintenance methods adopted for two American diesel flyers are given in the accompanying article. One of these trains, illustrated here, is the "City of San Francisco," a 2,400 b.h.p. oil-electric eleven-car train of the Union Pacific Railroad, which is now in service between Chicago and San Francisco. A similar train, but with an aggregate b.h.p. of 2,100, is maintaining a service between Chicago and the Californian coast at Los Angeles

The new stainless-steel Super-Chief train, hauled by the second 3,600 b.h.p. diesel-electric locomotive.

given a high-voltage test to insure that insulation is in perfect order. The maximum voltage of the power circuits under normal operation is about 600, and 2,400 volts are used for test purposes. The control circuit which uses battery voltage from 64 cells at 64 volts, is disconnected from the battery and tested at 600 volts.

Upon arrival at Los Angeles, the units are put over the inspection pit and wheels and running gear examined. All other inspections as outlined are made at Los Angeles excepting annual and monthly inspections, which are made at Chicago. No lubricating oil is changed at Los Angeles, excepting in cases where the viscosimeter shows exceptional conditions.

The City of San Francisco, U.P.R.R.

Several of the new maintenance problems resulting from the introduction of this diesel train are due to it being a complete unit, the nine trailing cars all being articulated. This train is 725 ft. long and at the head end are two power cars, each having a 1,200 b.h.p. vee type diesel engine, and two auxiliary engines for train lighting, air-conditioning and dining car appliances. There are also two steam boilers located in the second power car for the purpose of supplying steam heat throughout the train.

It was necessary to build up an organisation to handle the maintenance work with the greatest possible dispatch. This organisation includes men skilled in diesel engine repairs, steam-heating, air-conditioning, various types of electrical work such as telephones, radios, generators, motors and electrical refrigeration, as well as the latest type of brake equipment and automatic train control.

The West Alameda, Cal., electric shops were selected for maintaining the train. At these shops are long pits over which the train can be placed for making underneath inspection and performing the work pertaining to electrical apparatus. In addition, an electric drop-pit table, power lines for testing air-conditioning equipment, charging batteries, testing automatic train control and other apparatus were installed. Air, water and steam lines were provided for cleaning. For fuelling the train a standard 12,500 U.S. gal. tank car outside the west end of the shop was used and a 4-in. electrically driven pump mounted on top of it. From this pump was installed a pipe line with two outlets spaced to coincide with the filling valves on the two power cars so that both cars are fuelled simultaneously. From 600 to 800 U.S. gal. of fuel are required each trip and the fuelling operation can be accomplished in 5 min.

The City of San Francisco makes five round trips a month between Chicago and Oakland, a distance of 4,310 miles per round trip. It arrives at Oakland Pier at 7.22 a.m. and departs at 4.08 p.m. the following day. It usually arrives at West Alameda shops at 9.00 a.m. and leaves the shop at 2.00 p.m. the following day. During this short stay all the work of inspecting and repairing must be done.

When the train arrives at Alameda the front end of the train is placed over the inspection pit and underneath inspection made, the pit being long enough to accommodate approximately one-half of the train. When this is completed, the train is pulled forward and tests made of automatic train control equipment at the same time that the diesel men are making tests of individual cylinders to determine the condition of pistons, valves, injectors, &c. As a general rule, three pistons are changed out each trip and a record is kept to ensure all pistons being replaced every 50,000 miles. The pistons thus removed are reconditioned, new rings applied, and later re-installed in the engines on some succeeding trip. Cylinder heads are removed on the same schedule, reconditioned by cleaning, and grinding the valves, and later replaced.

While work on the engines is being done, inspection is made of underneath equipment of the rear portion of train, and car cleaners wash the exterior of the power cars. It is necessary to use a pit for underneath inspection, due to the skirt on the sides of each car preventing this being done from the ground level. Underneath inspection consists of pipe-fitters going under the train and running steam through the train line to check all steam traps; and carmen inspecting brake rigging, trucks, wheels, and underframe.

This work usually takes about two hours, at the end of which the inspectors are ready to report on what repairs will be necessary. The various jobs designated by the

inspectors are written up and numbered, and each man has his instructions written on a slip of paper. At the completion of the job he signs his name to the slip and is responsible for his work.

The train is then moved back and the power cars placed over the pits for draining the lubricating oil. This is changed each trip and requires 106 U.S. gal. for each engine. Diesel men and electricians then begin any repairs that may be found necessary in the power cars. At the same time, the trailing cars are cleaned inside and out, brake tests made, and repairs and adjustments of brake rigging and trucks carried out.

It is considered an important item to keep the yellow and brown exterior in good condition to preserve the attractiveness of the train. After being washed and rinsed it is rubbed down to bring out the gloss. Travelling at high speed across deserts and through dust storms has the effect of sandblasting the finish from some parts of the cars and trucks. This finish must be restored during the layover, and the usual practice is to spray three coaches each trip on a rotating schedule.

The machine and bogie shop at West Alameda, incidentally, is located in the same building and adjacent to the inspection shop, so that a minimum of time is consumed in transferring parts from one shop to the other.

When it is necessary to remove wheels and to make extensive repairs to brake rigging, the train is moved to a position where the truck requiring the repairs is over the drop pit, the car shored up, the bogie removed and a spare bogie moved into place. The bogie to be repaired is then transferred to the adjoining bogie shop, where facilities are available for disassembling and re-assembling the bogie. It is most important to maintain adequate material stocks for the streamliner, as any one car cannot be cut out and another substituted, or the locomotive changed. The two men who travel with the train are required to keep the depots posted by telegram as to the condition of the train and whether any unusual repairs will be required during the next layover. Receiving this information in advance affords an opportunity to secure the necessary material if it is not in stock. On occasions the material has been ordered by telegram and delivered by airplane to Alameda. On other occasions orders have been telegraphed ahead, material placed on other streamline trains coming from other points, the material transferred *en route* and brought in on the City of San Francisco.

Some time ago an emergency stop was made that necessitated changing nine pairs of wheels. The information was telegraphed ahead and when the train arrived the material was ready, a crew was waiting to perform the work and the train left on time. There have been occasions when the mechanics have boarded the train at Sacramento, Cal., and begun the work of dis-assembling one of the power plants or boilers while the train proceeded on its way to Oakland. This is possible because over that comparatively level territory the train can maintain speed with only one power plant working. The men are required to inform the shop as to any unusual repairs to be made on arrival at the terminal. However, it sometimes develops that this work cannot wait and must be done *en route*. Extra parts are carried on the train. Now and then the men travelling with the train are called upon to change *en route* a cylinder head, a piston and sleeve, an injector, or to make repairs to some parts of the electric or air-conditioning systems. If the repairs are to be made on one of the power plants, the engine is shut down and the train operated on one power plant until the repairs are completed. Changing out a piston and sleeve requires about 22 min. and a cylinder head can be changed in 12 min.

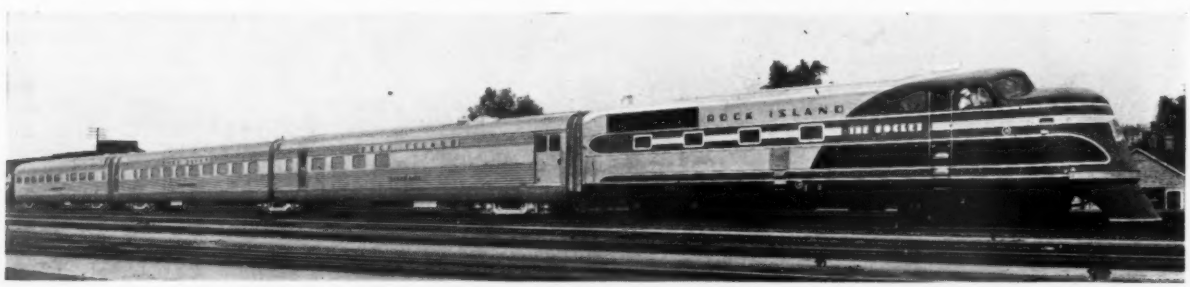
The facilities at the West Alameda Shops are to be increased for handling a new and finer City of San Francisco which will go into service early this winter. This train will operate on the same schedule as the present one and will be powered by three diesel-electric power cars, each having 1,800 h.p. or a total of 5,400 h.p. for the train.

MAIN-LINE LOCOMOTIVES IN AMERICA

Single-engined units for long-distance business services with light trains

REGULAR operation between Chicago and Peoria, 161 miles, has been inaugurated with the first of the six new diesel-hauled Rocket trains of the Chicago, Rock Island & Pacific Railroad. As announced in the January 22 issue of this Supplement, these stainless steel trains—four of three cars and two of four cars—were ordered specifically for fast interurban duties, and the remaining services to be operated are from Chicago to Des Moines, 358 miles; the Twin Cities to Des Moines and Kansas City, 493 miles, Kansas City to Denver, 636 miles, with connections to and from Colorado Springs; and from Fort Worth to Dallas and Houston, 283 miles.

There will be two 60 m.p.h. services each way daily by the Peoria Rocket, giving a daily mileage of 644. Between Chicago and Des Moines there will be one daily return trip with a total mileage of 716 at an end-to-end average



1,200 b.h.p. diesel-electric locomotive at the head of a three-car Rocket train

1,200 b.h.p. Winton-engined locomotive, Chicago, Rock Island & Pacific Railroad

of 61·5 m.p.h. On the Twin Cities—Kansas City route two Rocket trains will be in service, each maintaining one single trip of 493 miles a day at a 55 m.p.h. average. Only one Rocket will be used on the Kansas City—Denver service; it is to make three return trips a week at a throughout average of 60·6 m.p.h. westbound and 52·5 m.p.h. eastbound. The sixth train will maintain a daily return service between Fort Worth and Houston, supplementing the present Zephyr service of the Burlington Lines.

Locomotive Design

Unlike most of the American fast diesel trains, the Rockets are hauled by entirely separate diesel-electric locomotives, the nominal output of which is 1,200 b.h.p. irrespective of whether three-car or four-car trains are being hauled. The three-car sets tare 118 Engl. tons and the four-car rakes 148 Engl. tons, this light weight being attained by the use of high-tensile stainless steel built up on the Budd Shotweld principle. Each locomotive has the Bo-Bo wheel arrangement; it is 59 ft. long and weighs 100 Engl. tons with a full-load of fuel and supplies. The power-weight ratios for the complete trains thus are 5·5 b.h.p. per ton for the three-car unit and 4·85 b.h.p. per ton for the four-car assemblies.

Built by the Electro-Motive Corporation, the locomotives have a 16-cylinder vee two-stroke Winton engine and General Electric transmission equipment. The bogies have 36-in. wheels spread over a base of 8 ft. 6 in. and are pitched at 34 ft. centres; each axle is driven by a self-ventilated nose-suspended motor through 25:52 gears, which give an aggregate starting tractive effort of 55,000 lb. The body framing is of welded high-tensile steel, with the side frames in the form of trusses tied very rigidly by the underframe and also cross-braced at the roof. The centre sills of the underframe are designed to absorb a static end load of 400,000 lb. in addition to taking the vertical load of the engine and equipment. The bogies are of the swing link equalised type with cast steel frames, and they are fitted with hydraulic shock absorbers to improve the riding. Timken roller bearing axleboxes are used, and the wheels are of heat-treated carbon-molybdenum steel. Westinghouse straight and automatic air brakes are incorporated, and operate two shoes per wheel through four cylinders per truck.

Another difference from the general run of American high-power diesel trains is that the auxiliaries are not driven by a separate small oil engine, but from an extension of the main generator shaft, the auxiliary generator and exciter being mounted above the main generator and driven from it by vee belts. This machine operates in conjunction with a 32-cell 450 amp. hr. Exide ironclad battery. The two-stage compressor is driven from the main shaft through a flexible coupling. The fin-tube radiators are suspended in two banks from the engine room roof, and are cooled by means of four engine-driven fans 26 in. in diameter, which build up a pressure of about ½-in. of water in the engine room, the air escaping to the atmosphere through the radiator banks, and also downwards through ducts to the traction motors. The Winton engine needs no description here; it has been described several times in past issues of this Supplement when dealing with other American trains, and the whole Winton range was described in detail in the May 14, 1937 issue. The fuel is carried below the underframe in one tank which has a capacity of 1,020 U.S. gal., sufficient for a run of about 1,000 miles. Fuel is delivered to the injection pumps by an electrically-driven feeding pump.

Two Vapor-Clarkson automatic oil-burning flash-type steam generators supply the heat for the train; each plant has an evaporative capacity of 1,200 lb. of water an hour at 200 lb. pressure. This equipment is located at the back end of the locomotive, and has a feedwater tank of 1,265 U.S. gal. common to both generating plants.

THE N.Y.N.H. & H.R.R. COMET.—Supplementing the information given in our February 19, 1937, issue regarding the maintenance and design of this streamlined diesel-electric train, it may be mentioned that the centrifugally-cast nickel-cast iron cylinder liners of the Westinghouse engine have shown an average wear of 0·0185 in. in 140,000 miles. The maximum diametral wear before scrapping as recommended by the engine maker is 0·075 in.

RAILCAR OIL ENGINES

A variety of French makes are described in this, the third, instalment of a survey of the world's leading types

THE types of engines originating and used in Continental countries other than Germany (for German engines see September 3 issue) number about two dozen, in a great variety of powers, but despite the far-reaching application of oil engines to railcars in France, there are only five makes native to that country, and even then one of them, the C.L.M.-Junkers, is derived from a German design, but has been so much developed by the licensee that it deserves to rank as a French design. The native makes are the Renault, Berliet, Lorraine, Panhard, and C.L.M.-Junkers; the Saurer engine, largely used in France, is of Swiss origin, although those engines used in France are built at the French works of the Saurer company. This applies also to the Sulzer engine, which, as yet, has been used only for locomotives in France. Engines built under licence in France are the M.A.N. (by the Acieries du Nord and the Soc. Générale de Constructions Mécanique); Ganz (by Als-Thom); Mercedes-Benz (by Codra and Unic); Deutsche Werke Kiel (by the Ac. du Nord de la France et des Mureaux); and Frichs (by Corpet Louvet).

Renault

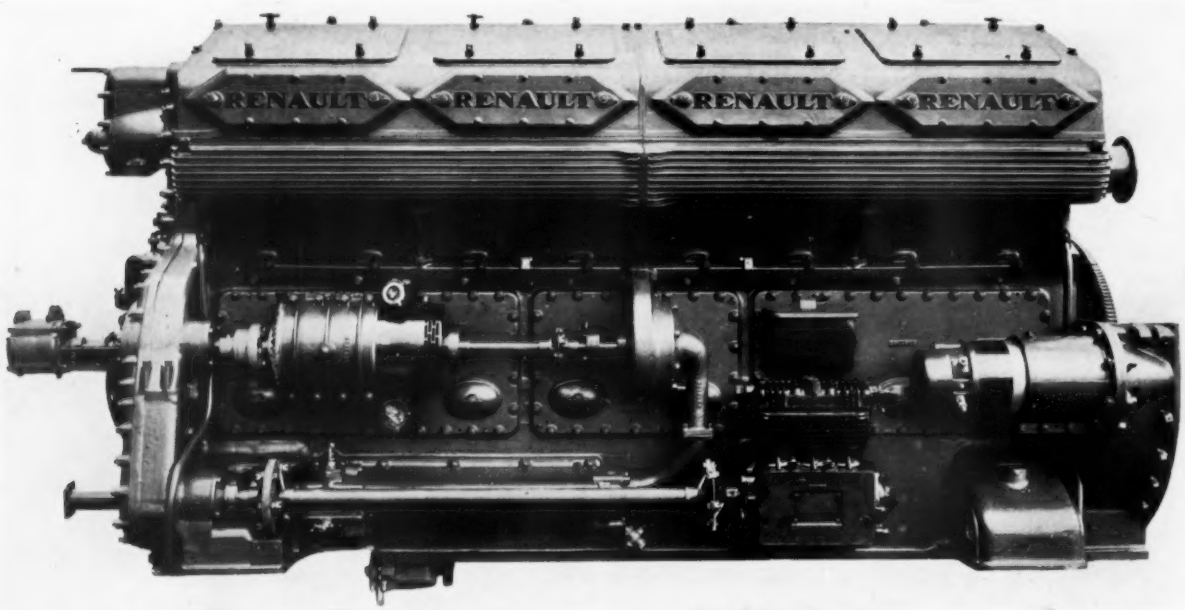
The first railway oil engine by Renault was a six-cylinder 85 b.h.p. model, introduced in 1930. Since that time it has been developed into a 100 b.h.p. unit by increasing the cylinder bore from 115 to 125 mm. and making sundry improvements without affecting the weight. The first Renault vee engine, rated at 220 b.h.p. continuously, was developed into the 265 b.h.p. model by an increase of 10 mm. in the cylinder diameter, and, more recently, the rating of this second engine has been raised to 300 b.h.p. as a result of putting in two inlet and two exhaust valves per cylinder, instead of one of each, and making other detailed changes.

As now made, the Renault range covers four engines, as follows:—

(*a*) A six-cylinder engine with a continuous rating of 100 b.h.p. and a maximum rating of 120 b.h.p., both at 1,500 r.p.m. The cylinders are 125 mm. by 170 mm., the weight 2,210 lb., and the full load fuel consumption about 0·46 lb. per b.h.p. hr. The nickel-chrome steel crankshaft runs in seven bearings having whitemetal lining on steel shells, these bearings being supported by a cast-iron crankcase which is integral with the cylinder block. Cast-iron pistons are used, running in liners, and the injection is direct through the Bosch type of equipment.

(*b*) A six-cylinder 150 b.h.p. engine forming one half of the standard 300 b.h.p. 12-cylinder vee engine, with the necessary changes to the crankcase and details. It weighs 17 lb. per b.h.p. and has a normal full load fuel consumption of 0·39 lb. per b.h.p. hr. Full details of acceptance tests with one of the engines were given in the issue of this Supplement for October 30, 1936.

(*c*) A 12-cylinder 300 b.h.p. model running at 1,500 r.p.m. and having a top output of 330 b.h.p. at the same speed. The cylinders are 140 mm. by 170 mm. and the weight 4,820 lb.; on the normal rating the piston speed is 1,670 ft. per min. and the brake m.e.p. 82 lb. per sq. in. The compression ratio is approximately 16 to 1, and fuel is injected directly at a pressure of 2,850 lb. per sq. in. by a Précision pump delivering through a central atomiser. The crankcase and cylinder block are formed of an integral casting of aluminium alloy which has separate cast-iron liners inserted. Cast aluminium alloy is used for the separate cylinder heads, and the pistons also are of an aluminium alloy and are fitted with four



16-cylinder Renault engine having a rating of 500 b.h.p. at 1,500 r.p.m.

Six-cylinder Berliet engine with a continuous output of 135 b.h.p. at 1,500 r.p.m. This particular engine is installed in a double-bogie car on the P.L.M. Railway and is shown with the direct-coupled main generator on a common welded steel subframe

pressure and two scraper rings. Each cylinder head contains two inlet and two exhaust valves of chrome and cobalt steel respectively, the change compared with the preceding 265 b.h.p. engine giving a better water circulation round the head, lower valve temperatures, and a greater volumetric efficiency. The main bearings of the nickel-chrome steel crankshaft are lined with whitemetal; those of the big ends have lead-bronze on the top half and whitemetal over the bottom half. This engine, and the preceding 220 and 265 b.h.p. ratings, are the most popular types of Renault engine, and there are over 220 of them at work in France, and others in Spain, Tunis, Algeria and Indo-China.

(*d*) A 16-cylinder vee engine developed from the 12-cylinder model, but having cylinders 156 mm. by 180 mm. The continuous output is 500 b.h.p. at 1,500 r.p.m. and the peak output 550 b.h.p. The details of construction are similar to those of the 300 b.h.p. engine, but in the first two engines built to this design needle roller bearings were applied to the big ends as well as to the gudgeon pins and connecting rod articulation joints. At 500 b.h.p. the piston speed is 1,770 ft. per min., the brake m.e.p. 77 lb. per sq. in., and the unit weight about 17 lb. per b.h.p. This engine was described in the issue of this Supplement for November 29, 1935.

Berliet

Transport oil engines built by the Automobiles M. Berliet number nine types varying from 50 b.h.p. at 1,800 r.p.m. to 135 b.h.p. at 1,500 r.p.m., but only six-cylinder engines of 100 b.h.p. or over have been used in railcar work. The 106 b.h.p. engine has cylinders 120 mm. by 160 mm. and runs at 1,600 r.p.m.; the 115 b.h.p. engine has 130 mm. by 160 mm. cylinders and runs at the same speed. The 125 b.h.p. engine has cylinders 130 mm. by 180 mm. and turns at 1,500 r.p.m.; it has a top output of 135 b.h.p. The last model develops a continuous rating of 135 b.h.p. at 1,500 r.p.m. and has a peak capacity of 150 b.h.p., but in the P.L.M. railcars the railway company's continuous rating is 125 b.h.p. at 1,500 r.p.m. This engine weighs 2,500 lb. and has a full load fuel consumption of 0·44 lb. per b.h.p. hr.

All the Berliet engines have the air-cell type of cylinder head, generally of the Acro type with the cell in the piston crown, but some of the recent engines of the smaller sizes have a double-turbulence Ricardo Whirlpool head. The compression ratio of the railcar types is 15 to 1, the usual compression pressure about 500 lb. per sq. in., the maximum gas pressure about 700 lb. per sq. in., and the injection pressure of the Bosch-Lavallette pumps 1,150 lb. per sq. in. The crankcase is cast of aluminium alloy and is surmounted by a single cylinder block of cast iron, above which are heads cast in groups of two. The nickel-chrome steel crankshaft is not hollow-bored, but is balanced by prolongations bolted to the crank webs; the main bearings have a whitemetal lining on a bronze shell and the big-end bearings whitemetal on steel backing. The camshaft is located in the top of the crankcase; it is chain-driven and carried in four bronze bearings. The same chain drives the water pump and the dynamo and a second chain drives the fuel pump on the opposite side of the engine. Some engines have gear-driven camshafts and auxiliaries. There are cast-iron liners inserted in the cylinders, and in these run aluminium-alloy pistons having five rings.

Lorraine

The Lorraine engine is used only in the railcars built for the Etat and Est systems by the Soc. Lorraine, which has the old De Dietrich works at Lunéville. At the moment there is only one model, in railcar service, developing a continuous output of 130 b.h.p. at 1,500 r.p.m. in six cylinders 126 mm. by 180 mm. The peak output is 150 b.h.p. at 1,700 r.p.m., and the weight including two starting motors and a dynamo is 1,800 lb. The fuel consumption at full load is 0·44 lb. per b.h.p. hr. and the lubricating oil consumption 4 to 5 gr. per b.h.p. hr. The idling speed is about 300 r.p.m. A 160 b.h.p. six-cylinder engine is available also.

A one-piece crankcase of cast aluminium alloy is used, but it is separate from the cylinder block, which also is an integral casting of aluminium alloy, with cast-iron liners of the wet type inserted in the cylinder barrels. The crankcase is well supplied with internal stiffening ribs and takes up the cylinder pressure reaction through long diagonal bolts stretching from below the bearing caps to the outside of the crankcase near the fuel pump and starting motors. The cylinder heads are individual interchangeable castings, and the six are covered by one casing of aluminium. Each head contains a pre-combustion chamber of special non-corrodible steel, an atomiser, and an inlet valve and an exhaust valve operated from a camshaft in the crankcase through long spring-cushioned adjustable push rods and rockers. The air intake is in two groups for three cylinders each, with an air filter above each intake manifold. The aluminium pistons have one scraper and four pressure rings, and are attached to the connecting rods through fully-floating gudgeon pins with needle roller bearings in the small end of the rod. The crankshaft is of high-tensile steel, hollow-bored throughout, and is supported on six plain and one centre roller bearings. Anti-friction metal is used for the six plain bearings and for the big-end bearings. Balance weights for the revolving masses are bolted to prolongations of the crank

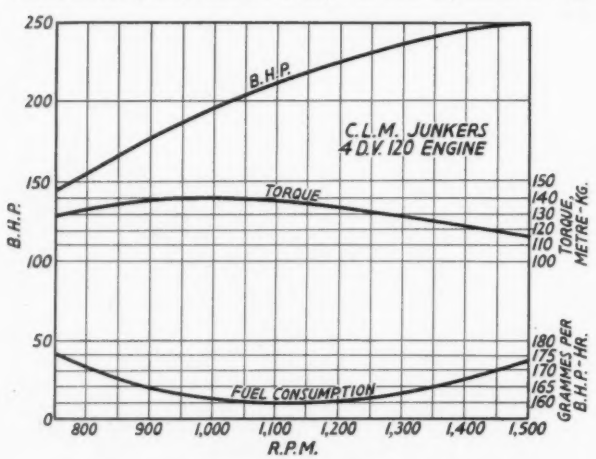
webs. A Bosch fuel pump is used, and the pressure lubrication system incorporates three pumps.

C.L.M.-Junkers

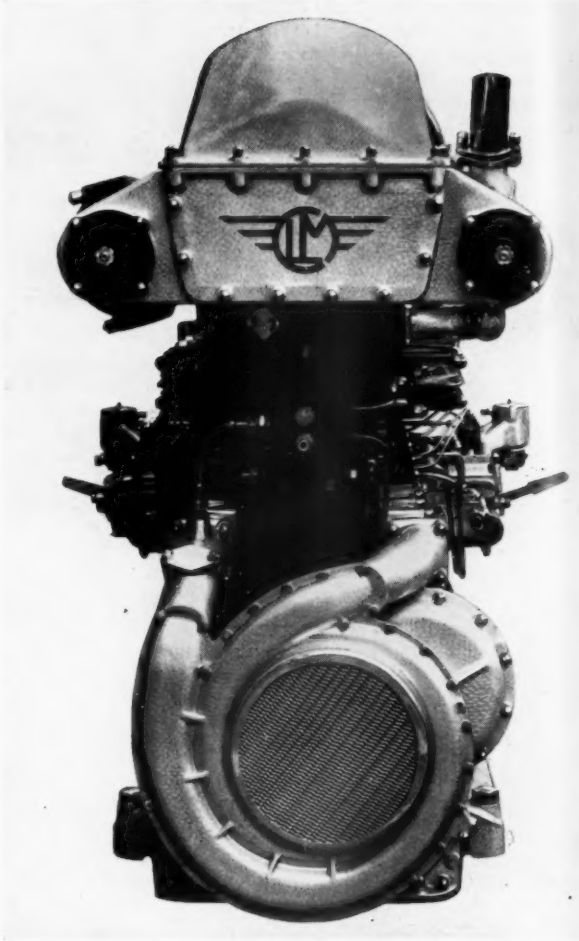
This make of engine is the only two-stroke type utilised in French railcar practice, and is unusual in being of the vertical opposed-piston type. For some years it was used only in the 80 and 105 b.h.p. sizes, on the Etat and Alsace-Lorraine systems and in Syria, but within the last two years 150, 250 and 500 b.h.p. models of improved design have been produced, and are in the front rank of railcar oil engines. A horizontal engine of 250 b.h.p. is in process of development. The makers are the Cie. Lilloise de Moteurs.

All types have one cylinder bank and two pistons in each cylinder moving in opposite directions. In the older 80 and 105 b.h.p. engines the lower pistons drive the output crankshaft directly, and the motion of the top pistons and crankshaft is transmitted to the output shaft through long I-section connecting rods, but in the newer models the two crankshafts are connected by gears to a common output shaft. The two sets of crankshafts and pistons, with their flywheels, turn in opposite directions, and as the moments of inertia of the two groups are the same, the balance is good and the cyclic variation is only about 1/130. Vibrations due to the reciprocating parts and to the engine couple are reduced to negligible proportions at all speeds.

Induction, exhaust, and scavenging are carried out without the use of valves, the bottom piston controlling the air intake and the top piston the exhaust events; the two sets of ports encircle the cylinder barrel, as may be seen from the accompanying sectional drawing of the 250 b.h.p. engine. At the end of a stroke the exhaust gases pass out through the top ports, and the scavening and intake air, from the engine-driven blower, enters at the bottom ports at a pressure of 350 to 370 gr., which not only fills the cylinders completely, but assists in driving the exhaust gases out. The intake ports are set tangentially to give a certain amount of turbulence, and the two sets of ports are so spaced that the bottom piston covers the intake port about 8 deg. of crank travel before the top piston closes the exhaust port. The blower is driven from one of the crankshafts. Fuel is introduced into the plain circular combustion space between the two pistons when these are at the inner ends of their strokes, and as there is no reaction to the gas pressure which is not taken up by a moving piston, there is no need for cylinder covers or fixing bolts. Each cylinder barrel has two C.L.M. pump rams feeding the two injection nozzles



Characteristic curves of C.L.M.-Junkers engine



Scavenging blower end of C.L.M.-Junkers two-stroke opposed-piston engine

on opposite sides of the cylinder; the injector and pump are combined in one unit and can be withdrawn from the engine in the same way as a sparking plug. A light metal sump is fitted to the bottom of the silumin cylinder block-cum-crankcase.

The types of C.L.M.-Junkers engine now made have the outputs and characteristics given in the accompanying table. From this table will be noted the very low fuel

C.L.M.-Junkers Two-Stroke Opposed-Piston Engines

Type	6DV. 85	ADV. 120	8DV. 120
No. of cylinders*	6	4	8
Cylinder diameter, mm.	85	120	120
Stroke of each piston, mm.	105	150	150
R.p.m.	2,100	1,500	1,500
Brake m.e.p., lb. per sq. in.	64	78	78
Piston speed, ft. per min.	1,435	1,480	1,480
Weight, with scavenging, per lb.	1,440	2,980	4,200
Continuous b.h.p.	150	250	500
Maximum b.h.p.	165	275	550
Fuel consumption at full load, lb. per b.h.p. hr.	0·375	0·353	0·353

* Each with two opposed pistons.

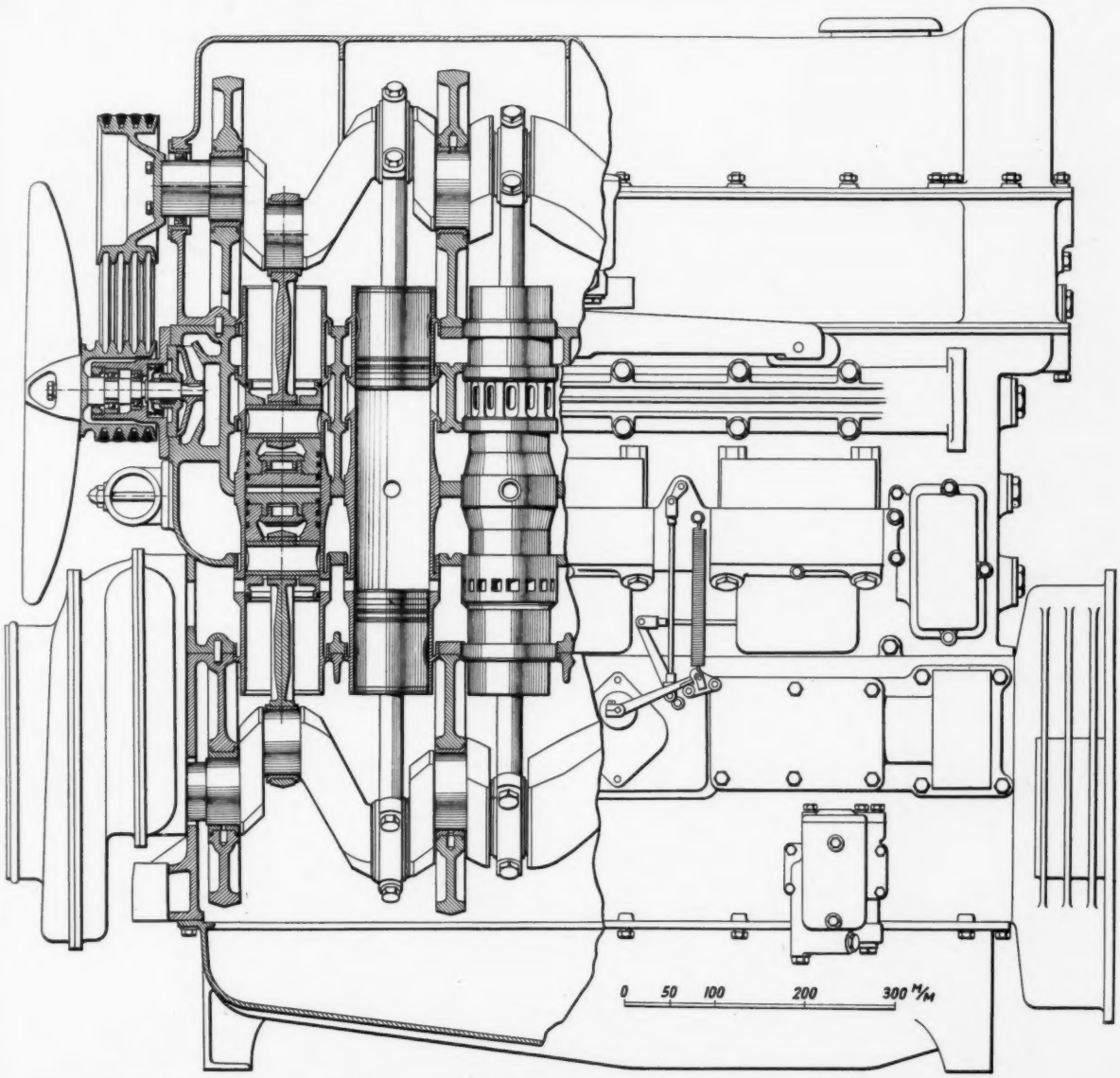
consumptions, the light weight, and, for a two-stroke engine, the high rotational speed, particularly with the 150 b.h.p. model, which is the only two-stroke railway oil engine to run at anything like 2,000 r.p.m. The lubri-

cating oil consumption of these engines averages 4·15 to 4·2 gr. per b.h.p.hr. at full load. Particulars of a 72-hr. continuous test with one of the 250 b.h.p. four-cylinder engines were given in the issue of this Supplement for September 4, 1936.

The older and smaller C.L.M.-Junkers models are of the three and four (double)-cylinder patterns. The three-cylinder unit runs at 1,500 r.p.m. and has continuous and maximum ratings of 80 and 88 b.h.p. respectively, and weighs 1,265 lb.; the four-cylinder model has continuous and maximum outputs of 105 and 120 b.h.p. at 1,500 r.p.m. and weighs 1,765 lb. In both types the cylinders have a bore of 85 mm. and a piston stroke of 2 × 120 mm., and the fuel consumption is higher than in the new range, being 0·44 lb. per b.h.p.hr. at full load. The pistons are of cast iron, as are the cylinder barrels, but the crankcase-cylinder block is of aluminium alloy. Both the connecting rods and crankshafts are of nickel-chrome steel, and the bearings of each have a whitemetal lining on a bronze shell. Similar materials are used in the new and more powerful engines. In all types the crankshaft has a bearing only between every other cylinder in addition to the end bearings. The 80 and 105 b.h.p. engines differ from the newer units in that it is the bottom pistons which control the exhaust and the top pistons the intake. The Compagnie Lilloise de Moteurs also has a range of smaller engines varying from 12 to 75 b.h.p. which are largely used in road transport work.

Panhard

The Panhard-Levassor diesel engine has been used only to a very limited extent in railcar work, and is made in a selection of sizes based actually upon lorry requirements. It is of a most unusual design, being of the double sleeve-valve type; there are two concentric sleeves dropped within the cylinder block, both of which are moved up and down by the action of a gear-driven auxiliary crankshaft in the crankcase, to which each sleeve is attached by a short rod. Two sleeves are used in order to reduce the amount of movement necessary to get adequate exhaust opening. As



Section through four (double)-cylinder C.L.M.-Junkers opposed-piston two-stroke engine of 250 b.h.p.

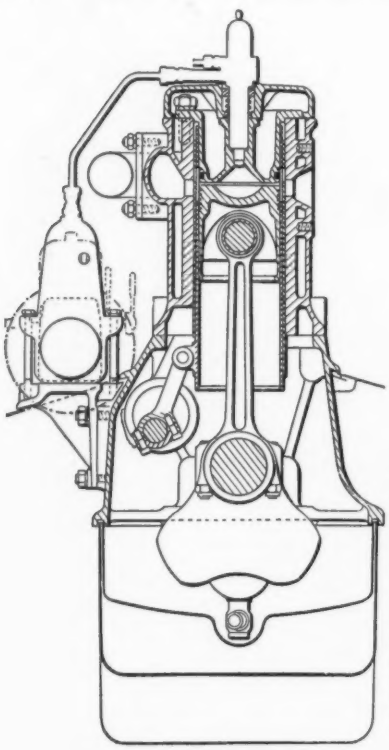
no valves are required, the cylinder heads are of peculiar shape, but are exceptionally well cooled, as may be seen from the accompanying sectional drawing. The walls of the cylinder block where it supports the sleeves are very thick; the cylinder block and the crankcase are separate castings bolted together. Panhard also makes a wood-gas engine for railcars; it is a modification of one of the standard petrol models and develops 210 b.h.p. at 1,600 to 1,650 r.p.m. in 12 cylinders arranged in vee formation. Here also the double sleeve-valve principle is used. It is this type of engine, and the Panhard producer, which are installed in the Somua railcar and the three new De Dietrich cars of the French State Railways.

Acenor and S.G.C.M.

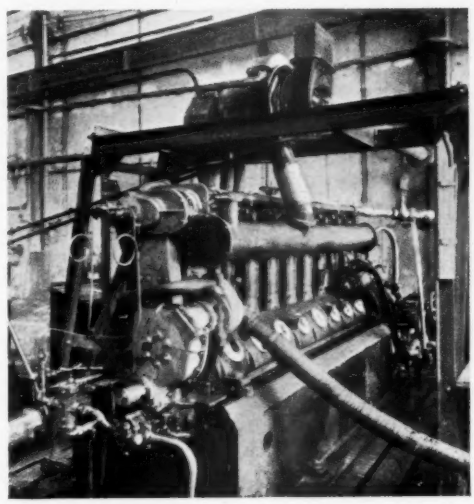
The Maschinenfabrik Augsburg-Nurnberg has two licensees in France, the Acieries du Nord and the Soc. Générale de Constructions Mécanique. The former has built railcar oil engines of 170 and 280 b.h.p. (Acenor), and the latter (S.G.C.M.) railcar oil engines of 140, 210, 280, and (supercharged) 350 b.h.p., in addition to bigger engines for locomotive installations. These engines are used in Acenor, the French "standard," and Somua railcars, and the 140 b.h.p. size in the conning-tower cars built by the Cie. Générale de Constructions, of St. Denis, for the Etat and P.L.M. systems.

The Acenor 170 b.h.p. engine has six cylinders 175 mm. by 220 mm. and develops its rated output at 1,400 r.p.m. on a weight of 3,100 lb. Bosch fuel pumps are incorporated, and they deliver the fuel directly into a plain combustion chamber. Nickel-chrome steel is used for the crankshaft and nickel steel for the connecting rods, and the six big-end and seven main bearings have white-metal lining on bronze shells. The cylinder block and crankcase are of cast iron. The 210 b.h.p. engine as built by S.G.C.M. has six cylinders 175 mm. by 180 mm. and runs at 1,400 r.p.m.; thus it is more highly rated than the 170 b.h.p. model, and has a weight only 200 lb. greater, viz., 3,300 lb. At full load and speed the fuel consumption averages 0·396 lb. per b.h.p. hr., and an M.A.N. pump is used generally and delivers the fuel through Bosch atomisers. A welded steel crankcase and cylinder block is embodied in oil engines to this design.

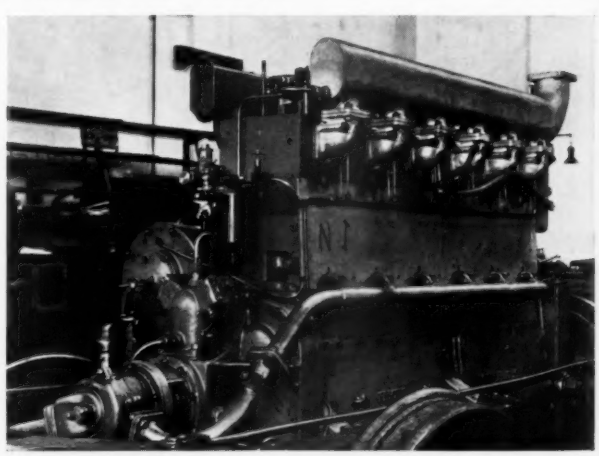
Eight cylinders are used in the 280 b.h.p. model, and they have the same low stroke-to-bore ratio as the 210 b.h.p. engine. The cylinders are 175 mm. by 180 mm., the rotational speed 1,400 r.p.m., and the weight 4,200 lb. The constructional details and materials are similar to those of the six-cylinder engine of 170 b.h.p. rather than to those of the 210 b.h.p. unit, but 13 of these engines built by S.G.C.M. for installation in P.L.M. cars built by Somua have welded steel crankcases and cylinder blocks, and are supercharged on the Rateau system to give a continuous output of 350 b.h.p. and a top rating of 385 b.h.p., both at 1,500 r.p.m. The increase in weight is only 270 lb., giving a weight of less than 13 lb. per b.h.p. on the continuous rating. The pressure produced by the exhaust-gas turbo-blower is only 1½ lb. per sq. in. in these installations, so that the increment in the continuous output due to supercharging is only 17 per cent., the remainder of the total increase being due to the increase of 100 r.p.m. in the speed compared with the 280 b.h.p. unsupercharged engine.



Section through Panhard double sleeve-valve type of diesel engine used in one or two light railcars and in numerous road vehicles. The Panhard producer-gas engine used in a railcar on the French State Railways has the same type of sleeve valves

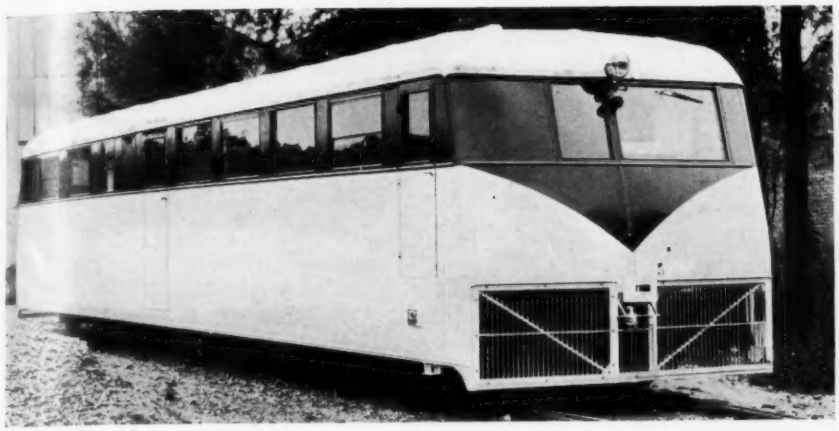


350 *b.h.p. supercharged S.G.C.M. (M.A.N.) railcar engine*



240 *b.h.p. Corpet Louvet-Frichs oil engine. Units of this make have been installed in French diesel-electric railcars*

LIGHT-WEIGHT RAILCARS OF UNUSUAL DESIGN



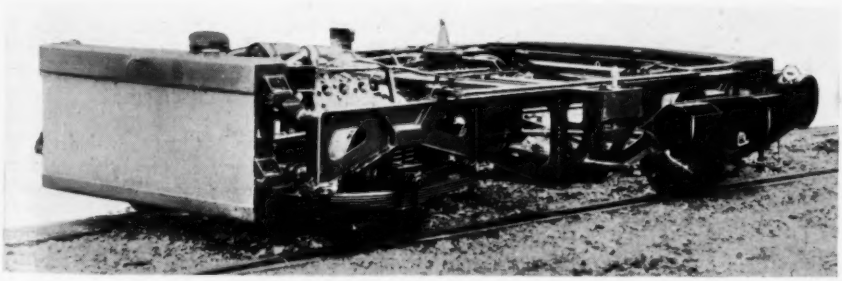
Left: 59-seater 47-ft. railcar taring 11 tons for service on the Peruvian Central Railway. A trailer can be hauled

Below: Third class saloon seating 39 passengers. The car has a lavatory and luggage room, and the windows are of the Quicktho half-drop type

TWO light-weight cars to an advanced mechanical design have just been built for the standard-gauge lines of the Peruvian Corporation by D. Wickham & Co. Ltd. Powered by two Ford V8 petrol engines developing 80 b.h.p. at 3,750 r.p.m., weighing only 590 lb., and located one on each bogie, these cars have a top speed of 60 m.p.h., and the engine torque is transmitted to the 24-in. wheels through a Vulcan-Sinclair fluid coupling and a four-speed Cotal electromagnetic epicyclic gearbox. The reversing gears are of Wickham's air-operated type, the spiral bevels being mounted on ball bearings and housed in a welded steel casing.

The combined body and under framing is built up almost entirely of round or square steel tubing, the four main longitudinals being $2\frac{3}{8}$ in. square and 10 w.g. thick, and braced by tubular cross members at intervals of 3 ft. 6 in.; there are two further tubular longitudinals at the sides, 1 ft. above rail level, which are cross-braced between the bogies, and the usual waist and cant rails, in this case of tubular section. The roof is supported on three tubular longitudinals with cross bracing, and the centre vestibule, 3 ft. wide, is stiffened by $1\frac{1}{4}$-in. tubular and $2\frac{3}{8}$-in. channel members beneath the floor. Further stiffening is given above the bogies by two 8-in. by 2-in. channels. The side and roof plates are of aluminium.

Welded steel construction is used also for the bogies, the frame structures of which are composed of $\frac{1}{4}$-in. side plates cross-braced by $2\frac{3}{4}$-in. square tubes at the centre and ends, and by various stiffeners. The car body is supported at both sides of the bogie by coil springs; the bolster is not of the swing type, and deals only with the forces of acceleration and retardation. In an endeavour to reduce the amplitude of the sine curve along which a pair of coned wheels progress when running on straight track, axlebox guides have been eliminated, and the axles are attached to the frames and kept parallel to them by means of radius bars. Further, the outer axles are of the fixed type, with roller bearings in the wheel hubs, and are cranked downwards to clear the engine. Clayton-Dewandre brakes apply two blocks to each wheel. The wheel centres are composed of two steel discs and distance bars welded together. Pneumatic sanding apparatus is incorporated, and there is an air-operated horn.



Welded steel bogie carrying engine and transmission. The wheelbase is 7 ft. 6 in. and the bogies are pitched at 31-ft. centres. The axleboxes are of the S.K.F. roller type, and the bolster is carried in a cruciform guide placed between rubber blocks

More British Railcars for South America

Hydraulic transmission with multiple-unit control incorporated in 15¼-ton vehicles intended to maintain schedule speeds of 37 to 45 m.p.h. with a top speed of 55 m.p.h.

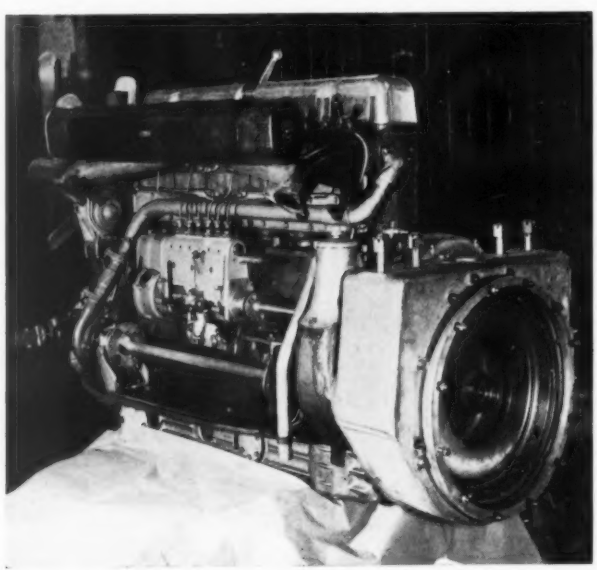
TWO diesel-hydraulic railcars have been shipped from this country recently for operation on the broad-gauge lines of the Buenos Ayres Pacific Railway. Built by the Birmingham Railway Carriage & Wagon Co. Ltd., they have Leyland oil engines and hydraulic transmission, and are designed for both single- and multiple-unit working. They were constructed to the inspection of Messrs. Fox & Mayo, the railway company's consulting engineers.

120 b.h.p. broad-gauge car weighing 19½ tons with maximum loading of passengers and luggage

Mechanical Portion

The cars incorporate a number of the features now associated generally with the normal practice of the builder, including all-steel welded construction with the body and underframe as an integral tubular unit; tapered body ends; and welded bogie frames. The body is constructed of metal throughout. The pillars are of light U-section steel, and these, together with the carlines and floor bearers, form continuous hoops round the body; the hoops are connected together at suitable intervals around the contour of the body by light steel pressed members. Aluminium side and roof sheets are riveted to the framing members. The ends of the car are suitably reinforced to allow a tubular cowcatcher to be mounted in front. Provision has been made for fitting fully automatic couplers abroad for multiple-unit working. These couplers will carry all the electrical and air connections for the control and brake, and by the simple process of pushing the cars together all connections will be made automatically.

The floor is formed of dovetail-section aluminium sheets covered with treated cork and finished with a layer of sponge-backed india-rubber; and the underside is sprayed with asbestos finished with a hard cement. The whole body is insulated against temperature change and noise by means of sprayed asbestos, which is applied to the inside of the outer aluminium sheeting and the back of the interior lining.

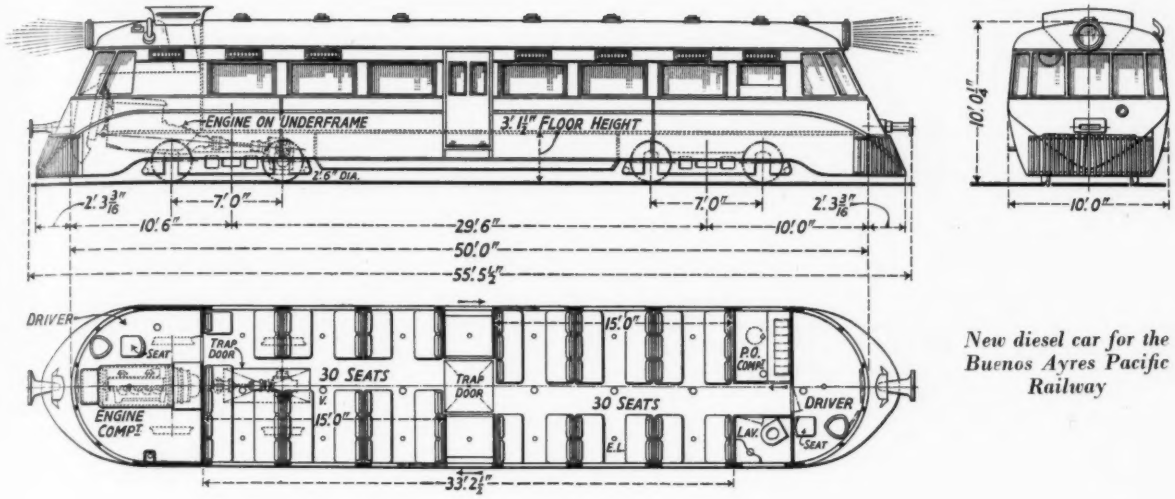


Six-cylinder Leyland engine rated at 120 b.h.p.

Scratchproof Rexine, in two shades of grey, is used for the lining of the passenger saloons, lavatory and postal compartment, and the ceiling is lined with cream Rexine. The seats, supplied by G. D. Peters & Co. Ltd., are finished in blue Rexine, and the india-rubber flooring is of a mottled brown shade. All the windows in the passenger saloons are fixed, and have above them Mead & McLean's Airstream ventilators, which are supplemented by Monarch ventilators in the roof. The exterior of the car is finished in crimson and cream, with a black line along the waist and round the nose; the roof is painted grey and the tubular cowcatcher at either end is finished black.

Access to the car is by a central vestibule provided with a sliding door on either side, and shaped with the body side to give as flush an appearance as possible when closed. The vestibule platform is below the level of the saloon floor, and a collapsible step is provided for mounting the car from the track level. This collapsible step is operated by a hand lever in the vestibule, and is so interlocked with the sliding entrance door that it is impossible to lower the step with the door shut, and also impossible to close the door with the step down; this precaution is necessary to avoid fouling the loading gauge. Between the bogies the underframe is completely enclosed by a removable undershield.

The bogies are to a design invented by Mr. R. E. Kimberley, Chief Mechanical Engineer of the B.A.P.R., and are of welded construction, fabricated, like the body framing, of high-elasticity steel. The bogie frame structure consists of two solebars of box girder section, tied together by tubular headstocks and four angle crossbars, two of which form diagonal braces. The four crossbars are tied together at the centre and form a slide in which a brass trunnion, pierced by the centre pin, can slide to take up the bolster throw, and at the same time transmit the tractive forces to the coach. The underframe has a fixed bolster with detachable ends which pass through the bogie solebar webs. These detachable ends are fitted with a swing link which supports the body through a ball joint. The swing link pierces the top flange of the bogie solebar and carries a coil spring which is mounted in a cup bearing on a bracket attached to the top flange of the bogie solebar. The effect of the ball joint and cup suspension is that the swing link and spring can pivot to take up any



New diesel car for the Buenos Ayres Pacific Railway

movement of the bogie on a curve, together with the bolster throw.

The axleboxes are of Timken roller-bearing type, on which are mounted elliptical springs pivotally attached to the bogie frame. The brakes are of the Girling type, supplied by the Consolidated Brake & Engineering Co. Ltd. They have expanding Ferodo-lined shoes working in brake drums bolted to the inside of the wheels. The wheels themselves are 2 ft. 6 in. in diameter and their discs are sprayed with asbestos to eliminate ring. The brake shoes are mounted on a split torque-plate carried on the axle and provided with graphite-lined bearings. A ratchet type hand lever is fitted in each cab to apply the brake on the adjacent bogie. This is accomplished by Bowdenex cables connecting the hand lever to the air cylinder lever.

Engine

Power is provided by a six-cylinder four-stroke Leyland engine, governed to develop 120 b.h.p. at 1,900 r.p.m. in cylinders having a bore and stroke of 4⅝ in. by 6 in. respectively. Fuel is regulated and supplied by a C.A.V.-Bosch pump, and is injected directly through C.A.V.-Bosch atomisers, turbulence being attained by a special form of dishing in the piston crown. The valves are operated by push rods in the usual fashion; the cylinder heads are cast in groups of three, and the Y-alloy pistons run in dry-type liners. The one-piece case-hardened crankshaft is carried in seven bearings housed in a cast iron crankcase. A description of the Leyland engine was published in the issue of this Supplement for August 6. The engine is carried on balata pads mounted on suspension beams attached to one end of the car underframe. It is completely protected from dust from the track. Air for cooling is drawn from the roof down a duct, over the engine, through the engine and torque converter radiators and expelled under the car, and the engine bonnet is sealed to act as a continuation of this duct. This feature is rendered necessary by the prevalence of volcanic ash in the district served by the railway.

Transmission

Mounted in the engine bell-housing is the Leyland Lysholm-Smith hydraulic torque converter. In essence, it is a centrifugal pump mounted in a single casing with a three-stage hydraulic turbine. The pump member is similar in form to the familiar water circulating pump. The turbine consists of a bladed rotor on which three separate rows of blades are fixed in such a position that they are divided by two rings of stationary blades fixed to the casing. The casing is completely filled with fluid, so that when power from the engine is transmitted to the pump, fluid is driven on to the rotor blades and through the stationary blades, thus enabling the torque to be increased on starting up to a ratio of 4·6 to 1. As the speed rises there is an automatic decrease in the torque ratio.

Clutches and Free-Wheels

The drive to the torque converter is taken through one or other of two friction clutches operated by a simple toggle mechanism. The clutch disc nearest to the engine is mounted on a shaft passing through the centre of the converter to the rear axle and provides the direct drive. The second clutch disc is mounted on a hollow shaft, the other end of which is connected to the impeller inside the converter casing, so forming the drive to the converter. Two free-wheel devices are incorporated in the transmission; one of them allows the converter to come to rest when direct drive is engaged, and the other is located in the direct-drive transmission line. This second free-wheel allows the engine to stop if trouble develops, thus preventing serious damage. It also relieves the drag on the train, which would otherwise be caused by a disabled engine being rotated, and relieves the clutches of wear, as it enables full engagement to be made before any torque is transmitted by them.

The final drive is by a double-reduction axle gearing, the first reduction being by spiral bevel gears and the second by spur gears fitted in an aluminium casing. In this design the bevel pinion is in constant mesh with two independently mounted crown wheels, which revolve in opposite directions. Between them is a spur pinion, which is in constant mesh with a larger gear pressed on the axle. A change in direction can therefore be obtained by moving the spur pinion into engagement with one or other of these crown wheels, the teeth of the spur pinion engaging with internally cut teeth in the crown wheels.

The traction unit, consisting of engine and transmission, needs only one train pipe and eight wires for its operation. These wires and pipe are led into jumper connections at each end of every car, thus forming a con-

tinuous connection when cars are coupled together to form a multi-unit train. Control is effected from any driving compartment from a control panel which contains:

(*a*) Throttle control valve.
(*b*) A three-position switch for the torque converter, giving direct drive, converter drive, and neutral.
(*c*) A two-way switch for forward and reverse.
(*d*) An engine r.p.m. counter.
(*e*) An ammeter.
(*f*) Three gauges showing the pressures in the control train pipe, the reservoir and brake cylinders.
(*g*) A warning light to indicate if the oil pressure or water level on any engine has fallen below the prescribed limit.

The engine control lever operates a variable-pressure reducing valve, which will vary the pressure in the train pipe between zero and 80 lb. per sq. in. The pressure acts upon a spring-controlled piston fitted in a cylinder fixed on the engine, and the increase or drop in pressure causes the piston to act on the governor control of the oil pump. The same lever is used to start and stop the engine. When full pressure is applied the starter on each engine (if not running) comes into operation and continues until the engine fires. Reduction of the air pressure in the pipe to zero cuts off the fuel injection and stops the engine.

Automatic stoppage of the engine is effected by a switch which cuts off the supply of fuel to the engine and stops it when the oil pressure falls below a pre-determined pressure. Similar automatic stoppage is also enforced when the water level of the cooling water falls below a pre-determined level. Stoppage of the engine from either of these causes lights external indicator lamps in the driving position; there are two of these lights, one indicating low oil pressure, and the other low water level, so that the cause of the stoppage is at once apparent from examination of the lamps.

Control of the torque converter clutches and the reverse gear on the final drive is effected by double-acting cylinders obtaining their pressure from a reservoir, admission of the pressure being controlled by magnet valves operated from switches on the control column. In the case of the torque converter control a rotary contactor is introduced to relieve the double-acting clutch mechanism of the torque converter of all pressure in each of its three positions, *i.e.*, direct drive, neutral, or converter drive. All magnet valves, rotary contactor relays, and the oil-pressure switch are contained in a dust-proof casing on the side of the engine, where they are accessible for inspection.

The compressed air for the control and brake is obtained from a compressor driven direct from a pulley on the output shaft of the torque converter, which pulley also has grooves for the drive to the generator. Both these drives are by means of Brammer belts. There is also an electrically-driven auxiliary compressor controlled by a governor which cuts in when the pressure drops below a pre-determined point. This auxiliary compressor acts as a booster should any small leak develop in the system, and is a means of keeping the car in commission should the main compressor fail.

DIESEL LOCOMOTIVE FOR PERU.—The Hunslet Engine Co. Ltd. has received an order from the Peruvian Corporation for a diesel mechanical locomotive powered by a Mirrlees engine with a Büchi supercharger. The transmission is to incorporate a Hunslet gearbox and a Vulcan-Sinclair fluid coupling.

RAILCARS FOR INDIA.—The North Western Railway of India is now calling for tenders for 11 diesel railcars and one spare power bogie, the projected purchase of which was noted in our issue of September 3. These cars are intended for operation on broad-gauge lines, and the budget allowance for their purchase was Rs. 13 lakhs.

Proposals for Express Railcars in Norway

*

SOME interest has been aroused in Norway by the appearance in the press of a statement made by the District Manager of the State Railways at Drammen, Herr Hoff, putting forward suggestions, said to be under examination by the general management, for improving facilities on the Bergen, Sörland and Dovre lines by means of express railcar services, similar to the *Lyntog* trains in Denmark, and the modification of the other services, both passenger and goods, to correspond. The public is said to be asking for speedier and more frequent means of communication; that demand cannot be effectively satisfied by making even a number of improvements without departing substantially from hitherto accepted methods of working. Not only are improved passenger services essential, but postal and goods services, too; it should be possible to provide them by reorganising the whole system of operation. The following fast railcar services are suggested:

Dovre Line.

Oslo	dep.	9.0 a.m.	and	2.0 p.m.
Trondheim	arr.	4.30 p.m.	,,	9.30 p.m.
,,	dep.	8.30 a.m.	,,	1.30 p.m.
Oslo	arr.	4.0 p.m.	,,	9.0 p.m.

Bergen Line.

Oslo	dep.	9.30 a.m.	and	2.30 p.m.
Bergen	arr.	5.0 p.m.	,,	10.0 p.m.
,,	dep.	8.0 a.m.	,,	1.0 p.m.
Oslo	arr.	3.30 a.m.	,,	8.30 p.m.

Sörland Line (when finished).

Oslo	dep.	8.5 a.m.	and	1.0 p.m.
Stavanger	arr.	4.30 p.m.	,,	9.30 p.m.
,,	dep.	8.30 a.m.	,,	1.30 p.m.
Oslo	arr.	5.0 p.m.	,,	10.0 p.m.

Cars making the journey from Oslo to Lillehammer in 2½ hr., Geilo in 3½ hr., and Kristiansand in 5 hr. 10 min. are also suggested. Intermediate stations on the routes would be served by a train arranged to be overtaken by the railcar at a certain point dependent on the total distance. Special expresses conveying parcels at night are advocated also. The reconstruction of the Westfold line, to be completed by 1941, should enable railcar services to do the run from Oslo to Skien via Tönsberg in under 3 hr. As much new railway rolling stock is wanted in any case, it would be a mistake not to spend the money in making a radical change in working at the same time, producing really substantial improvements.

The General Manager, Herr Heiberg has explained that these proposals are merely tentative. There was nothing impossible in them technically, but the economic factor had to be considered and the question was a complex one. Large sums would be required, not only for the railcars, but to put the tracks, with their numerous curves, in a condition to carry such services. Very high speeds were not practicable at present. Costs of upkeep would increase and the question whether there would be enough additional traffic to repay the outlay had to be carefully investigated. The State Railways already have four diesel cars on order—their delivery had unfortunately been much delayed—and until they had had sufficient experience with them it was not desirable to go further into the larger scheme.

[Another double-engined four-wheeled car with two 135 b.h.p. Mercedes-Benz engines has been at work for three years. It was described in the issue of this supplement for November 30, 1934.—ED.].

Supercharging

THE Büchi Syndicate advises us that only the Büchi system of supercharging is used by the Maschinenfabrik Augsburg Nürnberg for engines built in Germany (see p. 418 of the September 3 issue of this Supplement); it is the M.A.N. type of engine built under licence in France by S.G.C.M. that incorporates the Rateau turbo-blower.

A complete list of licensees of Büchi superchargers, not all for railway work, is given below. At the moment there are 115 diesel locomotives and railcars, aggregating 100,000 b.h.p., at work or on order with Büchi equipment.

General Licensees :
Brown, Boveri & Cie. A.G., Baden.
Cooper-Bessemer Corp., Mt. Vernon, U.S.A.
Harland & Wolff Limited, Belfast.
Humboldt-Deutzmotoren A.G., Köln.
John G. Kincaid & Co. Ltd., Greenock.
Maschinenfabrik Augsburg-Nürnberg A.G., Augsburg.
North Eastern Marine Engineering Co. Ltd., Wallsend.
Gebrüder Sulzer A.G., Winterthur.
Schweiz. Lokomotiv- & Maschinenfabrik, Winterthur.
Franco Tosi S.A., Legnano.
Werkspoor N.V., Amsterdam.
Brown, Boveri & Cie. A.G., Mannheim.
Cie. Electro-Mécanique, Paris.
Richardsons, Westgarth-Brown Boveri Limited, Hartlepool.

Individual Licensees :
Aciéries du Nord S.A., Hautmont.
American Locomotive Company, Auburn, N.Y., U.S.A.
Sir W. G. Armstrong, Whitworth & Co. Ltd., Newcastle.
Baldwin-Southwark Corp., Philadelphia, U.S.A.
Caterpillar Tractor Company, Peoria, Ill., U.S.A.
Daimler-Benz A.G., Untertürkheim & Gaggenau.
Davey, Paxman & Co. (Colchester) Ltd., Colchester.
Dennis Bros. Ltd., Guildford.
Deutsche Werke Kiel Aktiengesellschaft, Kiel.
A.G.d.Eisen- & Stahlwerke, Schaffhausen.
English Electric Co. Ltd., Rugby.
Fairbanks, Morse & Co., Chicago, Ill., U.S.A.
A/S Frichs, Aarhus.
Henschel & Sohn A.G., Kassel.
International-Plainfield Motor Company, Plainfield, U.S.A.
Kockums Mek. Verkstads A/B, Malmö.
Kolomna Eng. Works, Golutwin.
Fried. Krupp, Germaniawerft A.G., Kiel.
L. Lang, Maschinenfabriks-A.G., Budapest.
Leyland Motors Limited, Leyland.
Masch.u. Waggonbaufabr.—A.G., Simmering.
Maybach-Motorenbau G.m.b.H., Friedrichshafen.
Mirrlees, Bickerton & Day Limited, Stockport.
Mitsui-Bussan K.K., Kobe.
Motorenwerke Mannheim A.G., Mannheim.
National Gas & Oil Engine Co. Ltd., Ashton-under-Lyne.
Niigata Engine Works, Tokyo.
Nordberg Manufacturing Company, Milwaukee, U.S.A.
Otto Engine Works, Philadelphia, U.S.A.
Ruston & Hornsby Limited, Lincoln.
Adolph Saurer A.G., Arbon.
Scotts' S.B. & Eng. Co. Ltd., Greenock.
Tosi-Dujardin S.A., Lille.
Winton Engine Corp., Cleveland, U.S.A.

A statement issued in August by the American Locomotive Company, which organisation has taken out a Büchi licence after extensive investigations, says that this system seemed to offer the most practical means of increasing the air content of four-stroke engines. A unit was purchased and subjected to searching tests, including a thorough investigation of exhaust and charging phenomena by means of a Cox indicator with magnetic sampling valve. The results justified all Dr. Büchi's claims; in fact, by reason of good manifolding and valve timing as developed by indicator work, the application proved ideal. Indicator cards showed that there was no exhaust back pressure during the interval of overlap between inlet valve opening and exhaust valve closure. There are at present a number of Alco diesel-electric locomotives in operation with Büchi superchargers (*e.g.* the five 900 b.h.p. locomotives on the Birmingham & Southern Railroad), and others are under construction. The Birmingham & Southern locomotives incorporate what is really the Alco standard 600 b.h.p. engine with six $12\frac{1}{2}$ in. by 13 in. cylinders; the supercharger gives an increase of 50 per cent. in the full rated load at the same rotational speed (700 r.p.m.), and actually an output of 1,200 b.h.p., or an increase of 100 per cent., was attained, when certain modifications were made to the compression ratio, camshaft timing, and to the design of the intake and exhaust manifolds.

When the engine is idling, the exhaust gases pass out of the cylinders into the exhaust manifold and then pass into the turbine side of the supercharger, revolving it at approximately 3,000 r.p.m. The exhaust gases, after passing through this single stage row of turbine blades, go directly out to the atmosphere. On the same shaft with the turbine is mounted a turbo blower, which draws in air through a filter and forces it into the intake manifold. While the exhaust gases are coming out of one cylinder and through the turbine, the blower is forcing pure air under pressure into another cylinder, the timing of which is handled by the camshaft.

When the engine throttle is open and the governor set for a higher speed, more exhaust gases are produced and under a higher pressure. The increased exhaust-gas volume produces additional power in the turbine, which automatically speeds it up, and thereby pulls in more air, forcing it under a higher pressure into the intake manifold and then into the cylinders. When the engine is operating at full speed (700 r.p.m.) and full rated load (900 b.h.p.) in these Alco engines, the supercharger is revolving at approximately 12,000 r.p.m. The speed of the supercharger is entirely independent of engine speed and simply depends upon the amount of exhaust gas forced into it. This exhaust gas is forced in under a pressure of one or two pounds, and the blower forces air into the engine at a pressure of two to four pounds. This method of supercharging completely scavenges the cylinder and cleans out any impure exhaust gases left in it.

New South Wales Diesels

THE first of the four triple-car diesel-hydraulic trains of the New South Wales Government Railways has gone into tri-weekly service on the 422-mile line between Parkes and Broken Hill, and has reduced by eight hours the journey time between Sydney and Broken Hill. It will be recollected that these trains are powered by two 360 b.h.p. Harland-B. & W. two-stroke engines (see issue of this Supplement for January 22 last) and are fitted with Voith-Sinclair hydraulic transmission. The train consists of a power car with parcels and baggage room and three passenger cars. The power car has a driving cabin at each end, and the engine room contains two four-cylinder 34-b.h.p. National diesel engines to supply power for the auxiliaries, train-lighting, air-conditioning, heating and cooling in the buffet, and brake compressor. Aluminium-alloy rolled sections are used for the underframe longitudinals and transoms, for the floor plate and for the doors, but the body framing, roof and certain underframe members are of steel. Extensive use is made of anodised aluminium for the interior fittings. Seating accommodation for 52 first class and 106 second class passengers is provided, and the buffet is electrically-equipped and has a refrigerator, ice-cream freezer, cold milk container, cooling appliances, and storage cupboards. Meals will be served throughout the train from this buffet. The ceiling of the cars are panelled with sound-absorbing material and the side panels are insulated against temperature variation and noise. Sealed windows of double glass are fitted. Forced ventilation is installed; air is drawn in through a louvred recess in the roof, and after being cleansed is heated or cooled, according to prevailing conditions, and supplied in a constant stream to the saloons. The exterior of the train is finished in silver and blue. The train on the Broken Hill route is known as the Silver City Comet.

NOTES AND NEWS

Mexican Diesel Car.—The National Railways of Mexico are acquiring a diesel-mechanical double-bogie railcar for the 3-ft. gauge lines. It is to have a 110 b.h.p. Deutz engine and Mylius transmission.

Swedish Diesels.—Oil-engined locomotives incorporating 250 and 100 b.h.p. engines built under Hesselman patents are now being built by Nydquist & Holm and the A. B. Pentaverken, the engines themselves being built by the latter company in each case.

Leyland Extension.—A new factory for the manufacture of the standard types of oil and petrol engines is being laid down by Leyland Motors Limited; it will supersede the present engine assembly shop and will give a considerable increase in delivery capacity.

Fluid Couplings.—The Hydraulic Coupling & Engineering Co. Ltd. has received an order for two traction-type fluid couplings to transmit 80 b.h.p. at 3,000 r.p.m. for installation in conjunction with four-speed Cotal electromagnetic gearboxes in two inspection railcars for Belgium.

Belgian National Railcars.—The railcar stud of the Belgian National Railways includes 28 diesel-mechanical and two diesel-electric railcars, and there are one twin-car and eight triple-car diesel-electric trains. A total of 3,093,792 km. was made by this stock and five steam railcars during the last financial year.

Diesel Traction in Denmark.—According to the latest statistics, the Danish State Railways have in service 12 diesel-electric locomotives, 8 diesel-electric three-car and four-car trains, 40 diesel-electric railcars, 15 petrol-electric railcars, and 33 petrol-geared railcars. The railcar and diesel train stock runs about 28 per cent. of the total train-km.

New Trains for the Etat.—The French State Railways are to acquire four twin-articulated trains, each to be powered by two 12-cylinder vee Saurer engines rated at 320 b.h.p. and driving through five-speed Mylius transmission of the same general type as that described in the issue of this Supplement for July 9 last. The top service speed will be 87 m.p.h.

Diesels at Paris Exhibition.—Among the diesel exhibits at Paris are the Reichsbahn 1-C-1 diesel-hydraulic locomotive; a 65 b.h.p. Deutz diesel-mechanical locotractor; a 12-cylinder vee Mercedes-Benz engine of 450 b.h.p.; a 1,400 b.h.p. set of Voith hydraulic transmission; one of the Fiat triple-car diesel-mechanical trains of the Italian State Railways (for part of the time only); one of the 100 small Gardner-engined diesel cars of the Belgian Vicinaux; one of the *Lyntog* diesel-electric trains of the Danish State Railways; and a 130 b.h.p. petrol-engined Nohab railcar from Sweden.

New American Diesel Locomotive.—The Davenport Besler Corporation is building a new type of double-bogie diesel-electric locomotive with an estimated weight of 90 tons; it is to have four 160 b.h.p. oil engines, built by the Caterpillar Tractor Company, each of which will drive its own generator. Any engine with its attached generator and one of the four traction motors can be cut out of service at will. A smaller Caterpillar engine is to be installed to drive the auxiliaries. Diesel-mechanical locomotives with an improved form of transmission are being built also.

French Railcar Costs.—According to M. L. Dumas, Ingénieur en chef adjoint du Matériel et de la Traction of the Nord, the maintenance, repair, and depreciation charges of diesel railcars vary from 70 to 76 per cent. of the gross operating cost. Figures which he gives show that the total working costs of the De Dietrich double-engined cars average 4·9 fr. per km., of which 2·39 fr. are due to maintenance and repairs and 1·34 fr. to depreciation. The Nord 820 b.h.p. triple-car diesel-electric trains have an overall cost of 10 fr. per km., of which 4·36 fr. are due to maintenance and repairs and 2·9 fr. to depreciation.

Horizontal Petrol Engine.—The Soc. Hispano-Suiza has developed for railcar work—more particularly of the pneumatic-tyred type—a 12-cylinder horizontally-opposed petrol engine with a nominal output of 550 b.h.p. at 2,000 r.p.m. The cylinders are 150 mm. by 170 mm. and the weight about 3·5 lb. per b.h.p. The overall length is 58 in., the breadth 40·5 in., and the depth 36·5 in.

Italian Local Diesels.—The Calabro-Lucane division of the S. F. del Mediterraneo now has in service three types of diesel railcars on the 950-mm. gauge lines in southern Italy. These three types comprise a two-axle non-reversible class with a 100 b.h.p. Brescia-Saurer engine, a four-speed mechanical transmission, and a tare weight of 7 tons; a double-bogie reversible class with two 125 b.h.p. Brescia-Saurer engines, electric transmission, and a tare weight of 20 tons (see issue of this Supplement for June 12, 1936); and a two-axle non-reversible combined rack and adhesion design with one Brescia-Saurer 125 b.h.p. engine, a four-speed mechanical drive, and a tare weight of 8 tons. The two last-named types have stainless steel bodies and frames built on the Budd system by the Piaggio company at Genoa. Altogether there are ten bogie and 35 four-wheeled cars. Another type of car used is the rack-and-adhesion vehicles built by Carminatti & Toselli, and described in the issue of this Supplement for July 12, 1935.

New Nord Railcars.—The C. de fer du Nord has passed an order for 17 diesel railcars of the so-called "standard" type. The Aciéries du Nord will make the bogies and look after the erection, the Etablissements Decauville will build the bodies and framing, and the engines will be of the Renault 12-cylinder vee 300 b.h.p. type. S.L.M.-Winterthur oil-operated mechanical transmission will be incorporated. The last vehicle of the order will be constructed as an observation car with glass all round. The completion of this order will bring the Nord's stock of "standard" cars up to 40. In addition, an order has been passed for 20 observation trailers of the standard type.

American Diesels.—The order for 11 diesel-electric locomotives contemplated by the Atchison Topeka & Santa Fé Railroad (see issue of this Supplement for May 14) has been confirmed, and as the locomotives are to be standard designs of the makers, delivery is about to begin. Two of the locomotives are to come from the Baldwin Locomotive Works, three from the American Locomotive Company, and six from the Electro-Motive Corporation. All will be of 600 b.h.p. Six locomotives of the same power have been ordered by the Patapsco & Back Rivers Railroad—three from Alco and three from the Electro-Motive Corporation. The Elgin, Joliet & Eastern Railroad, which acquired six 600 b.h.p. Electro-Motive diesel locomotives at the beginning of the year, has placed orders for another seven, five of the same make and two from Alco.